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VOLUME 14 • OCTOBER 1956 • NUMBER 4 JOURNAL OF ORAL SURGERY

Surgical treatment of benign hard tissue lesions of the oral cavity

■ *Henry B. Clark, Jr., M.D., D.D.S., Minneapolis*

The proper treatment of any abnormality of the oral cavity is based on a correct diagnosis, knowledge of the characteristics of the specific lesion, adequate treatment facilities, and the methodical application of these resources to the problem.

■ *Types of Lesions Encountered*

The commoner types of benign hard tissue lesions may be placed in three groups depending on the type of surgical procedure which will be required for removal. Those terms bearing the suffix—"oma" denote true tumors; the others indicate tumor-like conditions. The lesions may be listed as follows:

1. Lesions attached to the surface of bone (peripheral)
   Exostosis (buccal and labial exostoses; torus mandibularis; torus palatinus)
   Osteoma
   Ossifying fibroma
2. Lesions partially embedded in and partially protruding from bone
   Osteofibroma (ossifying fibroma; fibro-osteoma, or manifestation of fibrous dysplasia of bone)
   Paget's disease
3. Lesions within the jaw bones (central)
   Enostosis (bone scar; condensing osteitis; sclerotic bone)
   Odontoma (complex; compound; mixed)
   Anomaly (fused teeth; gemination; dens in dente)
   Cementoma
   Fibrous dysplasia of bone

Various other obscure or rare benign bone diseases may manifest themselves occasionally in the oral tissues, but those which have been listed are seen most commonly.

■ *Examination and Diagnosis*

As in all oral surgical conditions, everything possible should be done to establish the exact diagnosis of the lesion

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Professor and chairman, division of oral surgery, University of Minnesota School of Dentistry.

prior to operative interference. An adequate history is taken and thorough intraoral and extraoral visual and digital examinations made. General physical examination, hemogram, urinalysis, and certain blood chemistry determinations are done in selected instances. The judgment of the clinician must dictate whether the task is one of simple elimination of a readily identifiable bony protuberance or whether a serious differential diagnostic problem is present.

Complete dental roentgenographic examination is performed as a matter of course, and to this should be added lateral jaw, occlusal plane, and posteroanterior views in appropriate instances.

If a visible deformity is present, preoperative photographs should be made for purposes of record and for comparison with postoperative pictures. Impressions and study models should be considered if the degree of interest is sufficient to warrant this additional step.

■ *Indications for Surgery*

Although virtually every soft tissue abnormality found in the oral cavity should be either biopsied or removed, it is not always necessary with benign hard tissue lesions. One of the following indications should be present to warrant surgical intervention:

NEED FOR PATHOLOGIC IDENTIFICATION—If there is a suspicion of malignant disease (sarcoma) or a systemic disorder (Paget's disease) a biopsy should be done; otherwise it is not done prior to an actual operation. Most of the conditions described in this paper represent a significant exception to the general rule in oral surgical practice that a biopsy is secured of any lump or mass discovered on clinical examination. Many of the lesions described herein, such as mandibular and palatal tori, can be diagnosed on sight. Others, such as odontomas and anomalies of dentition, can be named with certainty after careful study of the roentgenograms.

All tissue removed at operation should be preserved in 10 per cent Formalin and decalcified sections prepared when any unusual condition is present. Specimens taken from commonplace lesions such as manifest tori may be preserved indefinitely so that microscopic sections might be secured if needed.

FOOD IMPACTION, SORENESS DUE TO EXCORIATION, OR INTERFERENCE WITH SPEECH OR MASTICATION—If a bulky or lobulated bony lesion causes food impaction, soreness or interference with speech or mastication, surgery may be justified even though complete eradication of all abnormal cells is not practicable or necessary.

INTERFERENCE WITH PRESENT OR CONTEMPLATED PROSTHESES—A bony prominence that causes interference in an area which will be covered by a metal or acrylic resin prosthesis should be removed for self-evident dental reasons.

■ *Preparation of the Patient*

It is highly desirable to defer any oral surgical operation until at least the second visit. This is particularly true in the case of the somewhat unusual conditions being considered here. In addition to the examination and the securing of needed preoperative records at the first visit, the den-

tist should explain carefully why the operation is necessary, what is to be done, what it will cost, and the nature of the sequelae. Roentgenograms taken during the first visit will be dried and mounted properly in time for the operation on another day. Occasionally, also, time is needed in advance of the operation to make a splint or temporary prosthetic appliance that will be used to hold a mucoperiosteal flap against bone and prevent formation of a large hematoma. Finally, deferring surgery until the second visit permits the dentist to learn more about the personality and temperament of his patient. All of these reasons combine to justify delaying the actual operation until all is in readiness.

■ *The Operation*

It has been the author's custom for many years to perform no elective oral surgical procedure without the benefit of certain basic features of equipment and assistance which have been termed "the seven minimum essentials." These have been previously described,[1-3] but briefly stated they are:

1. Adequate preoperative roentgenograms
2. A suitable anesthetic agent
3. The proper tooth extraction forceps and elevators
4. A standard tray setup for performing flap operations
5. Brilliant illumination, preferably from a headlight
6. An efficient assistant throughout the entire operation
7. Suction aspiration

In the operative technics presently to be described it will be assumed that these agencies are present and functioning properly.

The patient should be premedicated with .05 to .1 Gm. (¾ to 1½ grains) of secobarbital sodium or pentobarbital sodium, or with ethinamate (Valmid, Lilly) .500 Gm. (7½ grains) one half to three quarters of an hour before surgery. Acetylsalicylic acid 0.6 Gm. (10 grains) may be given at the same time so that the medication will be effective at the time when the local anesthetic wears off.

TECHNIC FOR REMOVAL OF SURFACE BONY GROWTHS—The operative plans for removal of a true osteoma, an exostosis, or an ossifying fibroma are much the same, regardless of what the pathologic composition may be. They are also much the same whether the lesion is located on the vault of the palate, buccal surface of the upper jaw, or lingual aspect of the mandible.

The design of the mucoperiosteal flap to be reflected to permit exposure of the underlying hard tissue should fulfill the following requirements: it should give adequate surgical exposure, have a base wider than the free margin to insure good blood supply for healing, and any vertical incisions should be placed over undisturbed bone. Figure 1 shows the steps for removal of a torus palatinus.

The incision is made with a Bard Parker scalpel blade no. 15, then the flaps are raised carefully using a sterile instru-

1. Clark, H. B., Jr., and Clark, H. B. Minimum essentials for tooth removal operations. J.A.D.A. 27:571 April 1940.
2. Clark, H. B., Jr. The seven minimum essentials for tooth removal, operations. J. Wisconsin D. Soc. 25:155 Sept. 1949.
3. Clark, H. B., Jr. Practical oral surgery. Philadelphia. Lea & Febiger, 1955, p. 130.

ment similar to a no. 7 wax spatula or other small periosteal elevator. The flaps are held back with traction sutures or hooks. Some tori may be clipped off quickly and cleanly with the mallet and a broad sharp chisel, but in most instances it is more satisfactory to resort to division into sections with the no. 560 cross-cut fissure bur and removal in piecemeal fashion by prying each section away with the chisel until only one remains. This final piece may be lifted away with the blunt nosed rongeur forceps or sheared off with the side-cutting bone forceps. As a rule an indefinite but helpful plane of cleavage exists which permits these bony masses to separate from the base nicely so that a minimal amount of final smoothing is needed. Bone files, rongeur forceps, chisels, or occasionally, a large vulcanite bur may be used to eliminate spines, ridges, or other irregularities. When the base is smooth, all bone dust should be removed with the aspirator, aided by irrigations from the water syringe. A careful search with the double-ended curet should be made for debris far under the flaps, because such foreign material, if not removed, is very likely to lead to the formation of a wound abscess.

The delicate mucosal flaps are replaced and held in position with inter-

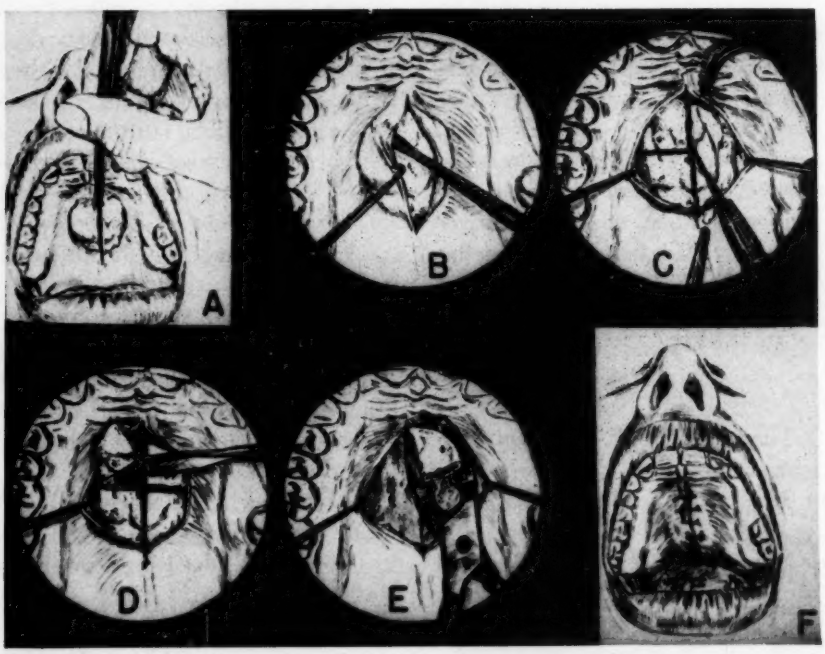

Fig. 1—Removal of torus palatinus. A: Incision. B: Elevation of mucoperiosteum. C: Sectioning with bur. D: Dissecting sections with chisel. E: Removal of last section with side-cutting bone forceps. F: Sutured wound

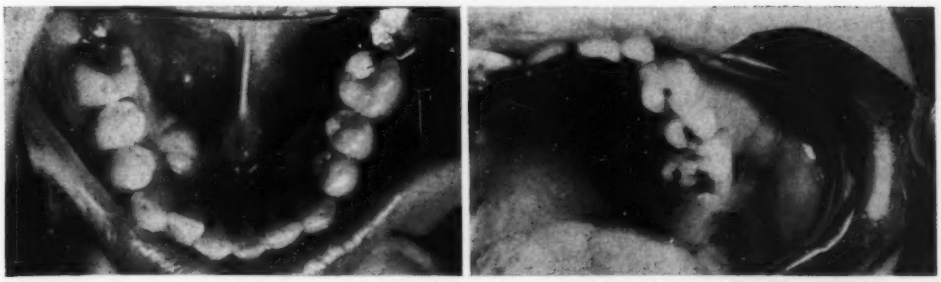

Fig. 2—Left: Torus mandibularis (mirror view). Right: Osteofibroma of left maxilla

rupted silk sutures. Firm pressure should be maintained through a folded gauze square for 20 minutes. The use of a palatal splint or of a packing held in place with wires arranged transversely in the molar and bicuspid area has been advocated by some writers. Great care must be exercised to avoid application of too much pressure, however, for necrosis of the soft tissues may result. The sutures are removed in 4 to 6 days.

The operation for the removal of mandibular tori is similar in principle to that used for the palatal lesion. Discrete lobulated tori may be clipped off with the mallet and chisel in many instances (Fig. 2, left). The mandible should be stabilized by placement of the patient's heel of his hand beneath the lower border to make this technic most effective. The broader type of lesions respond better if the bur and elevator are used. If lower teeth are present which are heavily coated with calculus, and if advanced periodontal disease is present, the elective operation for removal of tori should be deferred until the teeth and gingiva have been restored to a state of health. Otherwise the dislodgment of debris and bacteria into the deep lingual wound may cause a serious infection to develop in the floor of the mouth.

TECHNIC FOR REMOVAL OF LESIONS PARTIALLY EMBEDDED IN AND PARTIALLY PROTRUDING FROM BONE—Lesions that are partially embedded in or protruding from bone are similar to the growths which have just been discussed so far as technic for removal is concerned, although they are more nearly linked to the intraosseous lesions in pathologic nature, for these are essentially central lesions which have expanded sufficiently to produce changes in the surface contour.

Since the lesions are benign, and since they are often only a part of a generalized body disease, the indications for surgery are two—to recover tissue for microscopic study, or to restore the surface contour.

Figure 2, right, shows an osteofibroma which involved the left side of the maxilla. The patient complained of facial disfigurement and interference with mastication. The lesion was "pared down" to eliminate these complaints, but large quantities of tumor were left *in situ* since resection of the maxilla would not be indicated for this benign lesion.

Fig. 3—Dens in dente

TECHNIC FOR REMOVAL OF LESIONS WITHIN THE JAW BONES—The extirpation of a hard tissue lesion with a well developed capsule from the interior of the mandible or maxilla is accomplished in much the same manner as the removal of an impacted or unerupted tooth. Compound odontomas and anomalies such as dens in dente or fused teeth fall in this category. Any of these lesions may cause pulpitis or a pericoronal type of infection (Fig. 3).

On the other hand, removal of an intraosseous hard tissue object which has no capsule is a formidable task, and the indications for surgery should be specific before the decision to operate is made. The reasons for disturbing a region of sclerotic bone (enostosis) or a cementoma are very few indeed[4] (Fig. 4).

Figure 5 shows instances of mixed and composite odontomas which were separated from the surrounding bone by a fairly well developed capsule which facilitated removal. Removal of a complex or mixed odontoma which is not separated from the surrounding bone by a capsule, however, requires a high degree of surgical skill, sharp chisels and burs, and facilities for making roentgenograms during the operation to determine whether all abnormal material has been removed. Often the removal can be accomplished only by virtually resecting that portion of the mandible or maxilla, with the inclusion of a zone of normal bone along with the lesion. When it is realized that considerable deformity follows such a procedure, that the inferior alveolar or mental nerve may be injured, and that the antral or nasal cavities may be exposed, it is evident that such procedures should be amply justified before they are undertaken.

The wound remaining after removal of an infiltrating hard tissue mass seldom heals by primary organization of the clot. Therefore it is better to plan on periodic changes of a medicated gauze dressing so that the cavity can fill in by granulation. When this course is followed, a portion of the flap should be cut away to create a

4. Stafne, E. C. Periapical fibroma: roentgenologic observations. J.A.D.A. 30:688 May 1943.

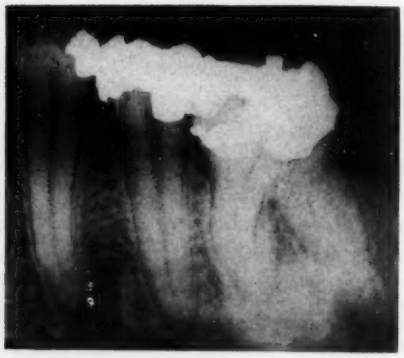

Fig. 4—Enostosis (condensing osteitis) around apex of mesial root of lower molar

window through which dressing can be introduced and removed readily.

■ *Preoperative Care*

After removal of hard tissue lesions, the instructions given the patient for home care should be written or printed, as with all oral surgical patients. Specific advice should be given about rest, diet, hot mouthwashes, the use of analgesics and sedatives and the steps to be taken in the event of hemorrhage or wound infection. An appointment for the first postoperative visit should be arranged.

Systemic administration of antibiotics is not advised unless there is some specific indication such as a previously existing infection, valvular disease of the heart, diabetes, or an extensive wound which quantitatively would stand a greater chance of becoming infected.[5]

Sutures should be removed on the fourth to sixth day. When primary healing is planned for and accomplished, no further care will be required. If an open bony wound remains, it should be dressed with a half-inch iodoform gauze strip anointed with a surface anesthetic agent such as an ointment containing benzocaine. The dressing should be removed, the cavity irrigated and dried, and a new gauze dressing inserted every four days. At the end of two to three weeks, the bone usually will be covered with firm pink granulations. The patient then should be instructed in the use of a small ear and ulcer syringe for irrigating the cavity once daily.

The making of postoperative roentgenograms, photographs, or study models constitutes the final step in the management of benign hard tissue lesions.

5. Zander, H. A., and Clark, H. B., Jr. Antibiotic therapy in oral surgery and dentistry. In Principles and practice of antibiotic therapy, Welch, H. New York, Medical Encyclopedia, Inc., 1954.

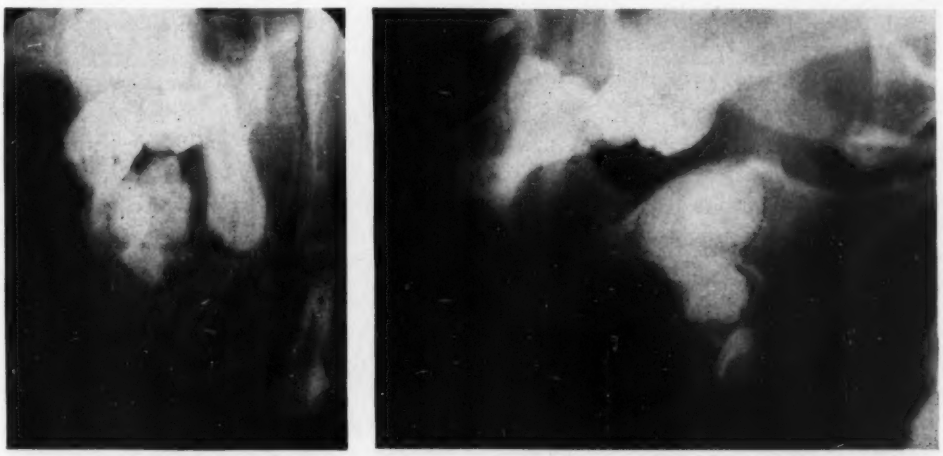

Fig. 5—Left: Mixed odontoma in maxillary bicuspid area of ten year old girl. Right: Composite odontoma in molar region of mandible

■ *Summary*

Benign hard tissue lesions of the oral cavity may be classified into three groups, on the basis of the method of surgical treatment: (1) surface, or peripheral lesions, (2) lesions partially embedded in and partially protruding from bone, and (3) central lesions, lying entirely within the substance of the bone.

Preoperative biopsy is seldom indicated for these types of lesions.

Surgery should be limited to those instances in which it is necessary to recover tissue for microscopic study, where food impaction or mechanical irritation are present, or where the growth would interfere with the comfortable wearing of a prosthesis.

The operation for removal of hard lesions requires a high degree of surgical skill and efficiency. Wide exposure, good illumination, and a bloodless field should be provided.

The removal of surface growths and small central lesions may be followed by primary closure. The defects remaining after removal of large central lesions are best handled by the insertion of a medicated gauze dressing which is changed periodically until healing is established.

The pin clamp as a bone stop

■ *H. L. Hubinger, D.D.S., Saginaw, Mich.*

Gunshot wounds of the jaw or extensively comminuted fractures of the mandible have a characteristic loss of continuity which universally results in collapse of the bone fragments and subsequent jaw deformity unless adequately treated (Fig. 1). Maintenance of the major fragments in their normal position combined with judicious débridement and adequate antibiotic therapy usually permit complete bony union to ensue. This is primarily due to the fact that ordinarily an adequate number of viable bone fragments is present in the defect with sufficient supporting periosteum to allow callus formation and eventual solid union and a restoration of continuity.

Kirschner wire and Steinmann pins have been used extensively in the treatment of mandibular and maxillary fractures to bridge across bone defects for stabilization of the fragments on either side. They eventually loosen, however, because of localized resorption and penetration, especially if they are placed in apposition to normal muscle traction. In an effort to prevent this, the wire may be bent in such a way that it tends to retain its position, but this is difficult to do with accuracy and also increases the bulk of

the appliance considerably. It has been my opinion that if a stop can be devised to oppose penetration, displacement and collapse of the fragments on either side of the defect can be prevented.

Recently, a Steinmann pin was utilized to bridge the defect between the fragments of a mandible fractured by close-range shotgun fire (Fig. 2, above left). At the time of operation the pin was driven into the posterior fragment, but only engaged the fractured surface of the anterior fragment under some tension. In an attempt to control further the posterior fragment, a wire was inserted

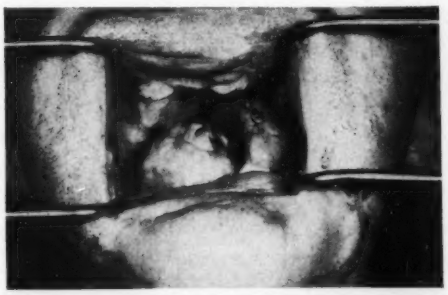

Fig. 1—Collapse of fragments in untreated fracture of mandible resulting from gunshot

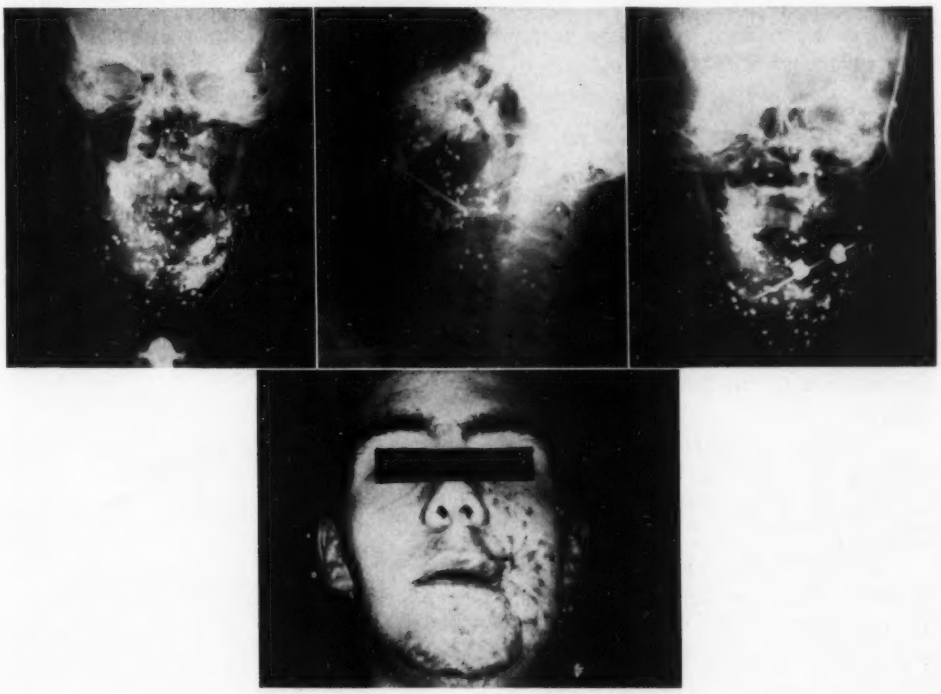

Fig. 2—Above left: Fracture of mandible prior to débridement, with tracheotomy tube in place. Above center: After débridement, with traction wire at angle of jaw, arch bars on opposite side and Steinmann pin across bony defect. Above right: Kirschner wire inserted through anterior fragment and driven into posterior fragment with pin clamps on median side of either fragment. Note wire post of plaster head cap. Below: Patient some months after occurrence of injury

Fig. 3—Fracture at symphysis. Note intranasal feeding tube and several broken segments of vulcanite denture in wound site

into the angle of the mandible and traction was established between the angle and the head cast (Fig. 2, above center). However, both procedures were to no avail since they did not control the fragments adequately. Roger Anderson pin clamps were then utilized as a stop on a Kirschner wire. This gave adequate firm immobilization of the parts (Fig. 2, above right).

The wire and pin clamps were left in place for four months. Bony regeneration and firm union had occurred by that time (Fig. 2, below).

Subsequently, another gunshot wound of this type came under my care. In this instance, the loss of substance was at the symphysis (Fig. 3). Primary treatment consisted of conservative débridement of the soft tissues followed by primary suturing of the wound. A tracheotomy was also done at that time to ensure an adequate airway.

Approximately ten days later, definitive treatment was instituted by insertion of a Kirschner wire through the floor of the mouth; the Kirschner wire was stabilized by pin clamps which were utilized as stops.

A hand drill with a Jacobs chuck that would accommodate the full length of Kirschner wire within the handle and chuck was used (Fig. 4). With this type of instrument it is possible to increase gradually the amount of wire propelled into the wound by loosening, readjusting and tightening the chuck on the wire. In this fashion the wire was started through a short incision in the skin near the inferior border of the mandible posterior to the fracture site. After penetrating the mandible, the wire was exposed through a small incision in the floor of the mouth near the median surface of the jaw, and a pin clamp was threaded onto the wire, but was not tightened. The wire was then driven through the tissues of the floor of the mouth until it engaged the median surface of the mandible on the opposite side. The wire was again ex-

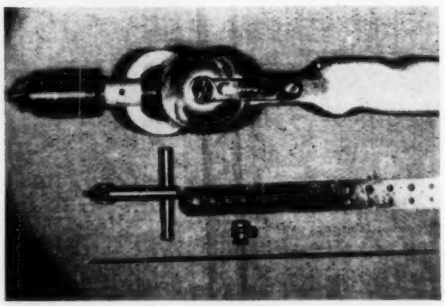

Fig. 4—Hand drill with Jacob's chuck that accommodates Kirschner wire within handle and chuck; wrench to tighten Jacob's chuck; steel ruler; Roger Anderson pin clamp and large gauge Kirschner wire

Fig. 5—Left: Posteroanterior view. Kirschner wire through bone of either side with pin clamps in place. At time of insertion of wire, intraoral débridement was done. Center: Few small segments of attached bone remain in defect, attached to soft tissue on labial side. Right: Final bony union after removal of appliance

posed through a small incision in this area and another pin clamp was threaded onto the wire. Penetration of the bone was then completed.

Stainless steel circumferential wires were placed around the body of the mandible to be used for lateral traction in reduction of the fracture. The fragments were then manipulated into their correct position and the pin clamps tightened on the wire with the wrench to prevent postoperative collapse of the fractured parts. Postoperative roentgenograms revealed the fragments to be held in good position (Fig. 5, left) with a sufficient number of smaller fragments to encourage eventual bony union (Fig. 5, center and right).

■ *Discussion*

The necessary plane or direction of the Kirschner wire through the symphysis area of the anterior fragment to engage the posterior fragment at the proper point in the first case was such that the wire and clamps were exposed intraorally. The final débridement ten days after the injury was also performed intraorally. In the preliminary planning of the second case, it was thought that the clamps could be placed on the wire extraorally. As it happened, the wire, even though located near the inferior border of the mandible, was more accessible intraorally. In both instances the wire ends were covered by suturing over the soft tissues and were not left exposed extraorally. Spontaneous osseous union usually occurs in severe gunshot fractures of the mandible when major fragments are controlled after débridement and toilet of the wound. Without the aid of antibiotics, an open procedure of this kind would probably end in failure.

■ *Summary*

The use of the Kirschner wire with the Roger Anderson type pin clamps as bone stops has been demonstrated in the two cases discussed. The large gauge (1.57 mm. or 0.062 inch) Kirschner wire with its spade-shaped pointed end is easily driven with the proper hand drill through the bone of the mandible. A Steinmann pin with a three-sided pyramidal type point is extremely difficult to drive through bone.—*501 Second National Bank Building.*

General anesthesia in dental office practice

■ *Harry M. Seldin, D.D.S., New York*

General anesthesia for dental office procedures is an integral part of the practice of dentistry. Despite the availability of potent, safe, local anesthetic agents, the need for general anesthesia in dental office practice continues unabated. The patient with cerebral palsy, the spastic patient, the frightened child and the adult emotionally unprepared for dentistry are best treated while under general anesthesia. Certain conditions in the otherwise normal adult demand the administration of general anesthesia in order to facilitate their correction. Thus, acute infections, swelling, pericementitis, trismus, pericoronitis and so forth are all best treated using general anesthesia. Many otherwise normal patients are emotionally unsuited for prolonged and uncomfortable experiences such as multiple crown preparation, impactions, multiple extractions, or alveolectomy. Local anesthesia usually eliminates pain associated with these procedures, but not the discomfort due to emotional trauma.

The widespread need for general anesthesia for dental operations cannot be met in the nation's hospitals. Hospitals today are severely overburdened and cannot possibly accommodate either on an inpatient or even outpatient basis the millions of patients who require general anesthesia for relatively minor procedures. Even if there were sufficient hospital beds, the costs involved in hospitalizing patients for minor dental procedures would make such a procedure impossible. General anesthesia for dentistry, therefore, must remain in the dental office and be administered or supervised by dentists.

This need for general anesthesia for dentistry has become so pronounced that a new branch has arisen within dentistry. These dentists employ general anesthesia for all patients referred to them (usually those who cannot otherwise obtain proper dental care).[1,2]

In adapting the newer anesthetic technics and using a variety of available anesthetic drugs and adjuncts, such as intravenous barbiturates and muscle relaxants, dental anesthesiologists are able to provide safe and satisfactory anesthesia for several hours, if necessary, for ambulatory dental office patients, thus making possible the completion of long and complicated dental procedures in one or two visits. Invariably these dentists have secured prolonged and thorough training in general anesthesia, and have attained competence equal to that of the medical anesthesiologist. Dentistry should be grateful to these dentists, for they have already played an important role in raising the standards of general anesthesia in dental office practice.

Presented as part of a panel discussion "Use of Local and General Anesthesia" before the Section on Oral Surgery and Anesthesia, ninety-sixth annual session, American Dental Association, San Francisco, October 18, 1955.

1. Spiro, S. R. Operative dentistry for the difficult patient under general anesthesia. D. Items Interest 73:483 May 1951.

2. Spiro, S. R. Endotracheal trichloroethylene anesthesia in operative dentistry. New York D. J. 20:464 Dec. 1954.

The oral surgeon is constantly confronted with the need for general anesthesia for his patients. More than 90 per cent of all oral surgeons routinely employ general anesthesia in their offices.[3]

In addition to these two groups of dentists, there are thousands of dentists in general practice who administer general anesthesia in their offices for specific situations or conditions when such anesthesia is required or desirable for both operative and surgical procedures. For these dentists general anesthesia is another adjunct in their armamentarium of sound dental practices.

This is as it should be, for the history of the use of anesthesia is marked by the contributions of dentists, and the record of safe employment of general anesthesia in dentistry is one that has yet to be equaled.[4]

To insure the right of the dental profession to continue to use general anesthesia, which is under serious threat from certain medical circles at the present time, dentists must demonstrate their thorough familiarization with modern concepts of anesthesiology, and their employment of general anesthesia must constantly and in every way reflect this knowledge. This must include not only the knowledge of drugs and technics, but also a fundamental understanding of the basis for the use of these drugs and technics, that is, the physiology and pharmacology of anesthesia.

General anesthesia for dental office procedures must be regarded today as almost a specialty within itself, differing from all other aspects of dental practice and, in a variety of ways, from the practice of general anesthesia in hospitals. It cannot be relegated to the hands of an untrained dental assistant whose function it is to manipulate the dials of an anesthetic machine under instruction from the dentist who at the same time is engaged in the performance of dental procedures. General anesthesia in the dental office must be administered by thoroughly trained personnel—dentist or nurse—whose sole function during the entire procedure is the maintenance of the patient in a satisfactory and safe anesthetic state.

■ *Stages of Anesthesia*

General anesthesia has been defined as a reversible paralysis of certain cells and cell derivatives, caused by chemical or physical influences. Although any cell can be paralyzed, the ideal general anesthetic agent should affect the centers of consciousness, pain perception, voluntary movements and muscle tone, while leaving the circulation, respiration and metabolism intact. Since all general anesthetic agents are effective only after they enter the circulation, the center of the brain which receives the greatest blood supply will be affected first by such agents.

The order of depression within the central nervous system is such as to permit varying degrees or depth of anesthesia as needed within safe limits. The most highly developed area of the central nervous system is the cerebral cortex, the site of consciousness. This is the first to be depressed. The midbrain, the site of muscle coordination and reflex action, is next affected. When this center is depressed, coordinate, purposeful reactions to pain are no longer

3. Seldin, H. M. Practical anesthesia for dental and oral surgery, ed. 3. Philadelphia, Lea & Febiger, 1950, p. 486.

4. Seldin, H. M., and Recant, B. S. Safety of anesthesia in the dental office. J. Oral Surg. 13:199 July 1955.

possible. Still deeper anesthesia affects the spinal axis. At this level, painful stimuli no longer elicit muscular movement, purposeful or otherwise. Finally the medullary centers, wherein lie the control of vital function as respiration and circulation, are depressed. The degree of depression of various centers in the brain is also thought to be due to the difference in sensitivity of these centers to the same concentration of the anesthetic agent.

This order of central nervous system depression is of prime importance. It permits the attainment of satisfactory levels of anesthesia, without danger of excessive vital function depression. The employment of the knowledge of the order of central nervous system depression, coupled with a thorough understanding of the actions, potency and effects of the various anesthetic agents as they relate to this phenomenon, is the test of competency of any anesthesiologist.

The degree of central nervous system depression has long been observed and classified into the "stages of anesthesia." For many years the accepted classification was the following:[3]

1. The first or analgesic stage.
2. The second or excitement stage.
3. The third or surgical stage.
   A. Light plane.
   B. Moderate plane.
   C. Deep plane.
4. The fourth or danger stage.

Today this classification is no longer dogma. The excitement stage almost inevitably is bypassed with intravenous barbiturates, and respiratory arrest is more synonymous with asphyxia than with anesthesia. Leonard Monheim,[5] a dental anesthesiologist, has stated a more modern classification which follows.

STAGE 1. PREPARATION—The preparation begins with the administration of any drug and continues as long as the patient is conscious and in harmony with his environment. It presumes mild cerebral depression, but not enough to produce semiconsciousness or unconsciousness.

STAGE 2. CHEMANESIA—Chemanesia is the state which begins when the patient no longer is in harmony with his environment. The patient is either semiconscious or unconscious, and is amnesic. There is initial loss of muscular coordination, indicating cortex and early midbrain depression. The patient will react to painful stimuli in an uncoordinated fashion. Simple dental extractions may be performed at this stage. The use of a local anesthetic agent combined with a general anesthetic that produces a chemanesic state permits the satisfactory execution of practically any dental procedure.

STAGE 3. SURGICAL STAGE—The surgical stage is divided into three planes.

Light plane. This plane begins with spinal axis depression. Respiration is rhythmically regular. Painful stimuli no longer provoke muscular movements, even though the muscles may not be relaxed.

Moderate plane. The spinal axis now is depressed further, and muscular relaxation is evident. There is initial depression of the medullary centers, which is accompanied by a gradual decrease in respiratory tidal volume.

5. Monheim, Leonard. Personal communication.

Depressed plane. Both the spinal axis and the medullary centers are depressed. The respiratory tidal volume and rate are obviously decreased.

■ *Signs of Anesthesia*

The anesthetist must determine in what level or stage he wants to maintain his patient, keeping in mind the requirements of the dental procedure being carried out. The patient should be maintained in a plane as close to this level as possible. Thus, for example, while the dentist is in the process of extracting a tooth, the chemanesic stage might well be sufficient. If the root fractures, necessitating the surgical removal of a root apex, however, the light plane of the surgical stage would probably be required since muscular movement would prevent careful, efficient surgery.

Fortunately there are extremely accurate guideposts to help the anesthetist determine the stage of anesthesia and thereby the degree of central nervous system depression of the individual patient. These guideposts are the "signs of anesthesia." They represent nervous impulses or signals which are exhibited through the muscular system. These signs are classified as follows:

1. Respiratory signs.
   A. Volume.
   B. Rate.
   C. Character.
2. Eye signs.
   A. Lid and lash reflex.
   B. Eyeball movements.
   C. Pupillary size.
3. Degree of muscular relaxation.

Within certain limits, these signs are accurate. Although the respiratory signs are the most important, the entire picture must be taken into account and interpreted at all times during the anesthesia. It is important to have faith in these signs, since they do not fail to reflect the patient's current condition. They become meaningless, however, unless the anesthetist is able to evaluate them on a minute-to-minute basis in order to be able to know at any time exactly in what stage of anesthesia the patient is being maintained.

■ *Signs of Physical Status of Patient*

As stated earlier, the function of the anesthetist is to maintain the patient in a satisfactory and safe anesthetic state. The satisfactory state is accomplished by keeping the patient in the proper stage of anesthesia with regard to the nature of the procedure being performed. The safety factor, on the other hand, is determined solely by the physiologic condition of the patient while in the anesthetic state, regardless of the anesthetic level. An old maxim of anesthesiology is that the anesthetist must strive to disturb the normal physiology of the patient as little as possible, within the limitations imposed by the nature of the anesthetic state.

Just as the stage of anesthesia can be determined accurately at any given time by the use of the signs of anesthesia, so too can the physical status of the patient be estimated with remarkable accuracy by the observation and evaluation of another set of signs. These, the signs of the physical status of the patient, can be categorized as follows:

1. Pulse.
   A. Rate.

B. Volume.
C. Rhythm.

2. Blood pressure.
   A. Systolic pressure.
   B. Diastolic pressure.
   C. Pulse pressure.
3. Color.
   A. Cyanosis.
   B. Pallor.
   C. Ashen gray.

These signs must not be confused with the signs of anesthesia. They do not reflect the stage of anesthesia or cerebral depression. These two sets of signs are both independent and interdependent, and the anesthetist must constantly observe, interpret and integrate both.

Of the signs of the physical status of the patient, the pulse is probably the most important and bears repeated and regular checking. Fortunately, changes in these signs are usually gradual and not sudden; therefore, the alert observer can be aware of early untoward change immediately, and can institute those measures necessary to overcome the undesirable reactions that the changes in these signs represent before these reactions reach serious proportions.

The classic, and probably most important, illustration of the significance of the changes in the signs of the physical status of the patient under anesthesia are those changes which occur as the result of hypoxia.

The first clinical sign of hypoxia is an increase in the pulse rate. Along with this there occurs a slight increase in the respiratory rate. If untreated, the hypoxia then results in an increased systolic pressure, while the diastolic pressure remains unchanged. As a result the pulse becomes slow and bounding. These are all compensatory changes. They occur slowly, permitting adequate time to observe and treat the condition they represent. If treatment is not instituted, decompensatory changes begin to occur, manifesting themselves as follows: The pulse becomes weak, slow and thready as a result of cardiac muscle ischemia. The blood pressure begins to fall. The pulse becomes weaker and arrhythmic, and cardiac arrest soon follows. The importance of a minute-to-minute check and evaluation of these signs cannot be sufficiently stressed.

■ *Choice of Agent and Technic*

Several factors must be evaluated and considered in regard to choice of anesthetic agent and technic. Dental patients routinely are ambulatory office patients. They usually arrive at the office a short time prior to the administration of anesthesia. They not only expect to have the required dental work completed rapidly and painlessly but also to leave the office in a short time free of the untoward or unpleasant effects which so often follow the administration of any general anesthetic.

The needs of the dentist must also be considered. The efficient completion of his dental operations demands a well-regulated anesthetic administration and maintenance during which the physical status of his patient is such as to permit him to operate without interference due to muscular movement of the patient in response to the painful stimuli of his procedure, or to the effects of the anesthetic itself. In addition, the arrival at the desired anesthetic state (induction) must be rapid, while recovery from the anesthetic

state must be equally rapid. The dental office recovery room should be inhabited by the patient for a short period. Thus three main factors are to be considered. In the order of their importance they are:[6] (1) the safety of the patient; (2) the convenience to the dentist and (3) the comfort to the patient.

Patient safety must always be the most important factor. This is particularly true in dental office anesthesia, where most procedures are elective.

Prior to the determination of which general anesthetic agent or agents are to be employed and which technics are utilized, it first must be determined that the particular patient is able to withstand the stress of general anesthesia. This determination generally called "preanesthetic evaluation" must be given to every single patient, child or adult, before a decision is reached to use a general anesthetic agent for that particular patient at that particular time. This evaluation by the dental anesthesiologist is independent of any medical examination the patient may have had, for regardless of what the patient's physician may advise, the responsibility for the patient rests in the hands of the dentist when that patient appears for treatment in the dental office. The purpose of this evaluation by the dentist is not to diagnose or prescribe treatment for the systemic conditions he may find, but rather to become aware of their presence and the possible effect they may have on the anesthetic, and to determine whether the patient should undergo a general anesthetic at that time.

The most important measures for preanesthetic evaluation that are available to the dentist are as follows:

1. A brief but pointed history. Questions are asked regarding the patient's age and activity; his ability to climb steps without undue fatigue; the presence of swelling of the ankles, shortness of breath or a cough; the need for several pillows for sleeping; the knowledge of any disease state such as diabetes, tuberculosis and so forth; past experience, if any, with anesthetics and surgical procedures; the use of alcohol, adrenal cortical steroids or other drugs, and the time of his last meal.

2. A simple physical examination. The pulse and respirations are examined. The general appearance of the patient is observed carefully. The presence of an acute infection of the upper part of the respiratory tract is ruled out.

3. The report of a recent medical examination, if available.

The dental anesthesiologist is concerned primarily with the patient's cardiovascular system. Dentists are not cardiologists and consequently cannot evaluate accurately every cardiac ailment; they must, however, use some means to determine the ability of the patient's cardiovascular system to withstand the burden that they may impose on it. The best guide to this ability is the knowledge of the patient's cardiac reserve. This reserve relates to the degree or ability of the patient's heart to increase its output above the basal value when such an increase is called for by the performance of exercise, work or other physical activity.

All dental office patients are ambulatory. Most of them are patients who engage in normal moderate physical activity and suffer the emotional and physi-

6. Cullen, S. C. Anesthesia in general practice, ed. 4. Chicago, Year Book Publishers Inc., 1954.

cal stress of modern daily living. If the patient is able to go about his daily activities which require such physical and emotional stress without showing symptoms of an inability to meet this stress readily, then the question of the ability of such a patient to withstand the stress of a properly chosen and well-administered anesthetic need not generate too much concern. By means of the examination described previously, a general picture of the cardiac reserve is obtained. Such symptoms as shortness of breath, fatigue on walking up one flight of stairs, palpitations on exertion, swelling of the ankles, or the need for two or more pillows for sleeping, would immediately alert the anesthetist to the possibility of a low cardiac reserve, and thus the need for a more thorough examination by a competent medical consultant.

The armamentarium of general anesthetic drugs is a large one. Many agents which offer advantages in hospital anesthesia, however, are unsuitable for office procedures.

The ideal office anesthetic drug would make possible the following:[5] (1) smooth, rapid, pleasant induction; (2) easy maintenance; (3) rapid recovery and (4) high safety factor.

No single known agent provides the dentist with all these requirements. It becomes necessary, therefore, to eliminate completely certain agents such as cyclopropane and ethylene, to use others such as ether and ethyl chloride only under special circumstances, and to combine two or more agents to produce a balanced anesthesia. In balanced anesthesia, drugs in combination are used to supplement and complement each other, producing satisfactory and at the same time safe anesthesia. Each drug is selected for its specific effect and according to the need for it. A prominent example of this is the use of thiopental sodium with nitrous oxide-oxygen.

Because of the requirement of sound dental office anesthesia, it would be well to limit the choice to the following agents and their combinations:

1. Nitrous oxide.
2. Divinyl oxide.
3. Trichloroethylene.
4. So-called ultra-short-acting intravenous barbiturates.
   A. Thiopental sodium.
   B. Thiamylal sodium.

NITROUS OXIDE—Nitrous oxide is a weak anesthetic agent. Induction using a slow technic usually produces very poor anesthesia, with noticeable and often violent excitement. This effect can be overcome in one of several ways. The use of a fast induction technic, using high concentrations of the agent, will usually produce rapid, pleasant anesthesia, particularly useful for short procedures such as the extraction of one or several teeth, or incision for drainage. This technic uses pure nitrous oxide for induction. Adequate amounts of oxygen are added to the mixture at the first sign of light anesthesia. Thereafter, satisfactory anesthesia may be maintained with high percentages of oxygen in the anesthetic mixture. Supplements such as divinyl oxide or trichloroethylene may also be added to the mixture as necessary. The author has used this technic in his office practice for hundreds of thousands of anesthesia administrations for oral surgical procedures. The onset of

anesthesia is prompt and usually of satisfactory depth, recovery is very rapid, and nausea extremely rare.

An alternative to this technic involves the use of trichloroethylene or divinyl oxide during induction in combination with nitrous oxide and oxygen. It offers the advantage of a high percentage of oxygen during the induction. Excitement may occur, however, and the incidence of postoperative nausea is comparatively high, particularly when trichloroethylene is used. Should postanesthetic nausea or vomiting occur, it often can be controlled with an injection of cyclizine lactate (Marezine), 50 mg. intramuscularly for adults and 25 mg. for children.[7]

The use of controlled premedication with one of the intravenous barbiturates is still another method used to potentiate nitrous oxide anesthesia. This provides what is probably the most satisfactory anesthesia obtainable for dental office practice today. The scope of dental office surgery under general anesthesia has been greatly widened by the use of thiopental sodium with nitrous oxide-oxygen. With this technic induction is extremely rapid and pleasant, anesthesia is completely adequate for all dental procedures, sufficient oxygen to prevent severe hypoxia is always available, recovery is relatively rapid, and postanesthetic nausea is extremely rare.

Further details of these technics will follow in the individual discussion of the various synergists. With regard to nitrous oxide itself, it should be understood that this drug is a true analgesic and anesthetic agent. It definitely depresses the cerebral cortex, without affecting either the cardiovascular or respiratory centers if severe hypoxia is avoided. It does not affect the salivary glands, the kidney, the liver, the vagal reflexes, the spleen, the vomiting center or the vasomotor center. These properties make this agent one of the most useful and safe anesthetic drugs in dentistry. In the absence of severe hypoxia, it causes the least postanesthetic depression.

DIVINYL OXIDE—Divinyl oxide is an effective cerebral cortex depressant. It does not affect the cardiovascular system, and the respiratory center is depressed only in the deeper planes of anesthesia. It does not affect the kidney or liver unless it is frequently used for prolonged periods.

Unfortunately divinyl oxide has several disadvantages. It has an unpleasant odor, produces excessive salivation and some postoperative nausea. It is highly flammable, and its use is accompanied by the danger of explosion.

Divinyl oxide is useful for rapid induction of anesthesia for children, using the open drop method. Oxygen via inhalation should be added immediately after induction. As such it provides adequate anesthesia for brief procedures. For longer periods of anesthesia, nitrous oxide-oxygen is added via inhalation. Divinyl oxide is also used as a synergist to nitrous oxide-oxygen anesthesia. In this method, the anesthetic mixture passes over a container of divinyl oxide liquid which volatilizes to join the inhalation mixture.

TRICHLOROETHYLENE—Trichloroethylene is a halogenated, unsaturated hydrocarbon. In concentrations usually found in the dental office, it is neither flammable

7. Marcus, P. S., and Sheehan, J. C. Treatment of postoperative vomiting. Anesthesiology 16:423 May 1955.

nor explosive even with oxygen. The presence of sparks or static electricity such as that generated by operations on or around the teeth will not produce explosion, as may divinyl oxide. It produces satisfactory analgesia and anesthesia. It is eliminated unchanged, mainly through the lungs. It is usually administered as an anesthetic in a semi-closed system with nitrous oxide-oxygen. Because of its relatively low volatility, it cannot be used efficiently by the open drop method. The closed circuit is also contraindicated, since the soda lime in the carbon dioxide absorber canister produces poisonous phosgene gas when trichloroethylene is passed through it. Trichloroethylene has no specific action on the fifth nerve; it simply raises the general pain threshold.

Liver damage may be produced by prolonged and repeated administration of trichloroethylene. In this respect trichloroethylene is like chloroform, cyclopropane and ethyl chloride. More important, however, are its effects on the cardiovascular system. Trichloroethylene is cardiotoxic. Arrhythmias are relatively frequent with its use. Auricular extrasystoles and ventricular tachycardia may occur. Its use, therefore, is contraindicated in the presence of disturbances in the conduction system of the heart. Therefore, it should not be administered to any patient with a pulse rate under 50. Thus is seen the importance of checking the patient's pulse prior to the administration of an anesthetic. During its use the anesthetist should repeatedly check the pulse for the presence of irregularities. If they occur, they can be readily corrected by halting the administration of the drug. Trichloroethylene sensitizes the heart to the action of epinephrine, further enhancing the possibilities of arrhythmias. It should not be used when epinephrine is administered.

Because it is relatively inexpensive, neither highly volatile nor explosive, and does not produce excessive salivation, trichloroethylene has been used in the last few years in the United States to replace divinyl oxide as a synergist with nitrous oxide-oxygen anesthesia. As such, anesthesia can be produced using a slow induction technic with adequate volumes of oxygen at all times. A large number of enthusiastic reports of its use as such can be found in the literature.[8-10] These reports, however, generally have tended to minimize the untoward effects which follow its use. Prolonged experience with its use has shown that postanesthetic nausea, transitory mental depression, and a general sick feeling or malaise on the part of the patient is a relatively frequent sequellum.

INTRAVENOUS BARBITURATES—Of the many barbiturates synthesized and tested, only a few have survived as intravenous anesthetic agents. These are hexobarbital sodium, thiopental sodium, thiamylal sodium, pentobarbital sodium and secobarbital sodium. Of these, hexobarbital sodium has generally been discarded. Secobarbital sodium and pentobarbital sodium, although classified as so-called short-acting or intermediate-acting barbiturates, produce prolonged recovery

8. Sadove, M. S.; Wyant, G. M., and Spence, J. M. Trichloroethylene in dentistry: general anesthesia. J.A.D.A. 48:425 April 1954.

9. Clement, F. W., and Seldin, H. M. Use of trichloroethylene and thiamylal sodium as adjuncts to other anesthetics in oral surgery. J. Oral Surg. 11:220 July 1953.

10. Ostlere, G. Trichloroethylene anesthesia. Edinburgh, E. & S. Livingston Ltd., 1953.

periods, rendering them of little use in the dental office.

The remaining two agents, thiopental sodium and thiamylal sodium, fall into the so-called ultra-short-acting barbiturate group and are of extremely great value in dental office anesthesia. It should be stated that "ultra-short-acting" is a misnomer for these drugs, for they have been shown to be metabolized much more slowly than was formerly believed.[11-13] Although the exact fate of thiopental sodium in the body is not known, it is believed that it is mostly bound to plasma protein, metabolized in the body, detoxified mainly in the liver, and stored in the lipoid tissues. Once in the body fat, the drug apparently passes back into the blood stream at a rate approximately equal to that rate at which it is detoxified in the liver; evidence has shown that the blood contains traces of the drug for many hours after the cessation of its administration. This fact is of great importance in ambulatory office anesthesia. Every patient given the drug must leave in the company of a responsible adult. The patient should be warned against driving an automobile, walking alone in the streets, or using sharp, revolving equipment.

During the early use of thiamylal sodium[9,14-16] it was felt that it had certain advantages over thiopental sodium. It was believed that there was less postanesthetic depression with faster recovery time, and greater depression of the laryngeal reflexes with less tendency to laryngospasm. Subsequent study and observation have proved that there is little difference in the pharmacologic actions of these two drugs. For this reason the discussion will be limited to thiopental sodium, which is the most widely used intravenous agent today.

A controversy exists as to whether thiopental sodium is merely a hypnotic, or a true anesthetic agent as well. Unlike most anesthetic agents such as nitrous oxide, ether and so forth, thiopental sodium does not produce a true analgesic state prior to the loss of consciousness. Not only the cerebral cortex but the respiratory center as well is always depressed in anesthetic doses. Complete apnea may follow the administration of even small anesthetic doses. At the same time, the sensitivity of the respiratory center to carbon dioxide stimulation is decreased, and the threshold of hypoxia stimulation of the carotid sinus is raised. These respiratory effects are extremely important.

A commonly used technic for office anesthesia consists of the administration of thiopental sodium as the sole anesthetic drug.[17,18] Since muscular relaxation is not required for dental procedures, light anesthesia just sufficient to obtund pain, which is possible with the use of thiopental sodium, is advocated without the use of any inhalation agent and without the use of

11. Brodie, B. B., and others. Fate of thiopental in man and method for its estimation in biological material. J. Pharmacol. & Exper. Therap. 98:85 Jan. 1950.

12. Brodie, B. B., and others. Intravenous anesthetics—new concepts; experimental aspects. Anesth. & Analg. 31:145 May-June 1952.

13. Lief, P. A., and others. Intravenous anesthesia—new concepts; experimental aspects. Anesth. & Analg. 31:147 May-June 1952.

14. Clarke, M. T.; Walton, C. H., and Bewersdorf, H. L. Clinical experience with Surital Sodium: preliminary report. Anesth. & Analg. 31:73 March-April 1952.

15. Phillips, H. S. Some clinical observations on the use of Surital Sodium in combination anesthesia. Anesth. & Analg. 32:56 Jan.-Feb. 1953.

16. Seldin, H. M. Anesthesia for office oral surgery with a clinical evaluation of thiamylal sodium. J. Oral Surg. 9: 314 Oct. 1951.

17. Krogh, H. W. Intravenous anesthesia in office practice. J. Oral Surg. 13:138 April 1955.

18. Eriksson, S. G. Clinical experiences from dentistry under general anesthesia. Anesth. & Analg. 32:377 Nov.-Dec 1953.

oxygen. The basis of such anesthetic technic is that since thiopental sodium decreases the rate and amplitude of respiration, it will take additional time for the inhalation agent, that is, nitrous oxide, to be sufficiently concentrated in the blood to be effective. During this time, the anesthetic effect of the thiopental sodium will wear off.

It is true that after the production of sleep with thiopental sodium, brief oral surgical procedures can be performed without the use of other agents. It is also true that intermittent administration of additional thiopental sodium alone will make possible the performance of most prolonged dental procedures. However, this is an unwise and unphysiologic anesthesia. The fact that respirations are decreased in rate and amplitude indicates that the patient is not getting sufficient oxygen even for his decreased metabolism. Such a condition would fall into the criterion of "anoxic anoxia" (hypoxia). In addition, the barbiturates themselves produce a histotoxic anoxia. McClure and others[19] in an exhaustive study of anesthetic drugs found "Barbiturates in therapeutic doses produce relatively severe anoxia [hypoxia] . . ." McClure, Behrmann and Hartman[20] in another study of anoxia in anesthesia found that when thiopental sodium (Pentothal sodium) was used for induction of anesthesia, and nitrous oxide-oxygen in a ratio of 70:30 for maintenance, the arterial oxygen saturation remained normal or above normal. When, on the other hand, thiopental sodium was used as the sole agent and the patient breathed room air, the arterial blood oxygen saturation fell to as low as 68 per cent.

Thiopental sodium may be used as a 2 per cent solution in distilled water, saline or dextrose. A sufficient amount is injected at a moderate pace until the eyelid reflex is lost or the eyeball becomes eccentric, and unconsciousness ensues. At this time a brief surgical procedure such as the extraction of one or two teeth may be performed without the addition of another inhalation agent. If the procedure is to last longer than one or two minutes, nitrous oxide-oxygen is added immediately after loss of the lid reflex so that the inhalation mixture contains anywhere from 50 to 70 per cent nitrous oxide and 30 to 50 per cent oxygen. At least 30 per cent oxygen by volume is administered at all times. If respirations are decreased sufficiently because of the effect of the thiopental sodium, the anesthetist assists the respirations by manipulation of the re-breathing bag or bellows in order to prevent respiratory acidosis.

The purpose of adding nitrous oxide is that thiopental sodium does not obtund pain reflexes unless deep anesthesia is accomplished. Nitrous oxide, being a true although weak anesthetic agent, will obtund the pain reflexes as required when it is potentiated by the effect of the thiopental sodium. Actually the thiopental sodium does not potentiate the nitrous oxide. Instead, it depresses the patient to the point where the nitrous oxide can be effective with relatively high oxygen percentages. By the employment of nitrous oxide-oxygen with the barbiturates, the

19. McClure, R. D., and others. Anoxia; source of possible complications in surgical anesthesia. Ann. Surg. 110: 835 Nov. 1939.

20. McClure, R. D.; Behrmann, V. G., and Hartman, F. W. Control of anoxemia during surgical anesthesia with aid of oxyhimograph. Ann. Surg. 128:685 Oct. 1948.

patient can be brought back to a normal physiologic state more rapidly.

Thiopental sodium depresses the respiratory and vasomotor centers. With increasing depth of anesthesia, there is a progressive decrease of cardiac index. The average fall in cardiac index is about 20 per cent. Blood pressure may fall suddenly, particularly when the drug is administered rapidly. Extremes of hypotension and hypertension are contraindications to the use of this drug. Shock or any severe drop in blood pressure also eliminates the use of thiopental sodium. Thus a patient going into syncope at the beginning of the administration of the anesthesia should be treated as though he were in shock and the administration of the thiopental sodium should be halted. Hypertensive patients who are being treated with blood pressure reducing drugs, such as reserpine, should not receive intravenous barbiturates on the same day of this drug therapy. The combination of the two drugs may produce a dangerous drop in blood pressure, since thiopental sodium itself may produce some fall in blood pressure, particularly if the thiopental sodium is injected rapidly.

Thiopental sodium does not affect the kidney, spleen, salivary glands, or liver. In patients with hepatic disease or damage, however, recovery is prolonged. The known presence of such disease is a sufficient contraindication to the use of the drug.

Thiopental sodium does not abolish the laryngeal and pharyngeal reflex. Indeed, hyperactivity of this reflex may occur in lighter stages of anesthesia. Any stimulation of the laryngeal reflex, therefore, may cause spasm or involuntary closure of the vocal cords, and may prevent gaseous exchange. Fortunately such spasms are rare. They can usually be overcome by pulling the chin up and the tongue forward, aspirating any blood, mucus or foreign material from the throat, and forcing oxygen. If these measures fail, the intravenous administration of a rapid and short-acting muscular relaxant, succinylcholine chloride, will produce brief but sufficient relaxation of the cords to break the spasm. Under such conditions, the respirations must be assisted.

Although adequate and often remarkable treatment is available to the trained anesthetist to relieve a patient in laryngeal spasm, the best treatment remains that of prevention. This can almost always be accomplished by following certain specific rules. The larynx must be kept free of blood, mucus and other foreign material. The tongue should be kept forward and the chin elevated. Manipulation should be minimal, consistent with the procedure at hand. Painful stimuli, another cause of laryngospasm, should also be avoided by maintenance of proper anesthetic depth.

Many medical anesthesiologists routinely use atropine preoperatively with thiopental sodium. Atropine definitely will decrease salivation. At the same time it is believed to depress the laryngeal reflex. There is some controversy about the latter property. In the offices of leading oral surgeons, spasms have been found to occur so infrequently without the use of atropine that its value is subject to question. The author does not believe that it is necessary to use atropine, particularly for brief procedures.

Since thiopental sodium has hypnotic and amnesic properties, its use in combination with local anesthetics has been

Table
Summary of anesthetic agents in relation to requirements for dental office practice

	Nitrous oxide-oxygen	Divinyl oxide plus oxygen	Nitrous oxide oxygen plus divinyl oxide	Trichloro-ethylene plus oxygen	Nitrous oxide-oxygen plus trichloro-ethylene	Thiopental sodium plus nitrous oxide-oxygen
Rapid induction	Possible with mild hypoxia +−	+	+	−	−+	+
Easy maintenance	−	+−	+	−	+	+
Rapid recovery	+	+	+	+	+	+
High safety factor	+	−	+−	−	+	+

studied. The author has found that prolonged and otherwise uncomfortable procedures may be performed in a pleasant and painless manner for the patient by using local anesthesia supplemented by thiopental sodium administered in small intermittent doses just sufficient to keep the patient in the analgesic or chemanesic state. Oxygen is administered throughout this procedure; however, prolonged administration of oxygen will interfere with ventilation and may cause an accumulation of carbon dioxide. Excess carbon dioxide will produce carbon dioxide narcosis resulting in cardiac conduction complications.[21] The importance of watching the respiratory exchange to assure proper ventilation is self-evident.

Although there are some dentists who use thiopental sodium intravenously for children, the problem of cooperation with regard to venipuncture usually is too great. In such instances thiopental sodium can be administered rectally in 5 or 10 per cent solutions while in the recovery room.[22] This puts the child to sleep even before he is brought to the dental operating room. Anesthesia may then be maintained by the use of inhalation agents.

The factors that are wanted in ambulatory practice must be considered. As stated before, these are (1) rapid induction; (2) easy maintenance; (3) rapid recovery and (4) high safety factor.

The table briefly summarizes the relation of the various anesthetic agents commonly used in dentistry to these requirements.

■ *Conclusion*

General anesthesia is an integral part of dental office practice. For thousands of general practitioners as well as specialists its administration in the dental office is an indispensable adjunct in the practice of dentistry.

The science of general anesthesia is complex. It demands rigid preparation not only in clinical anesthesia, but in the basic medical sciences as well. It has been said that the competent anesthetist must be an anatomist, a chemist, a physicist, a physi-

21. Morris, L. E. Report of Fourth Biennial Western Conference on Anesthesiology, March 1955, p. 88.

22. Thompson, E. C., and Linz, A. M. Atraumatic anesthesia for the child patient. J. Oral Surg. 12:319 Oct. 1954.

ologist and a pharmacologist. Beyond this, the science of general anesthesia in the dental office contains no secrets or mysteries that the trained dentist or nurse anesthesiologist cannot solve.

For short procedures nitrous oxide-oxygen anesthesia properly administered in the light plane produces unconsciousness and amnesia without any evidence of generalized postanesthetic depression. For more extensive surgery and other prolonged dental procedures in the dental office, controlled intravenous premedication with thiopental sodium and light nitrous oxide-oxygen anesthesia provides the patient safe and pleasant sleep devoid of severe hypoxia and postanesthetic depression. Deep planes of thiopental sodium anesthesia are dangerous and should be avoided.—*57 West 57th Street.*

Management of medical and anesthetic emergencies in oral surgery

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The best treatment of emergencies is their prevention. Thus, a study of their origins is important. Emergencies occur because of predisposition on the part of the subject and untoward results of ministrations by the surgeon, anesthetist and aides.[1]

When an emergency is present, its exact nature must be recognized immediately so that proper treatment can be applied. Prevention and treatment succeed most often if a code of procedure for each situation has been laid down in advance.

In a busy office practice, it is customary for the oral surgeon to rely on a visual classification of patients,[2] whereupon they are sorted into those difficult to anesthetize, average persons, and those unusually susceptible to anesthesia.

Ideally, each patient should have a history taken and a physical examination performed. At least, a few important questions should be asked about the state of the heart and lungs, about when food was last taken, and about sensitivity to local anesthetics, penicillin and other drugs. If any threatening situation is discovered, physical examination is more definitely indicated, and it may be necessary for a consultation to be held with an internist.

Paper read at the annual meeting of the American Society of Oral Surgeons, Los Angeles, October 13, 1955.

1. American Society of Anesthesiologists, subcommittee on postgraduate education for the part-time anesthesiologist. Outline of anesthetic emergencies. Chicago, American Society of Anesthesiologists.

2. Principles and practice of administering nitrous oxide-oxygen. Madison, Wis., Ohio Chemical and Surgical Equipment Co.

If increased hazard is determined, special steps may be taken to improve the risk, involving transfusion, digitalization, antibiotic therapy, or other appropriate treatment, and possibly hospitalization.

The nature of the oral surgeon's responsibility in the hospital surgery is different from that in his office. In the hospital, his anesthesiologist may be depended on to detect signs of unusual complications as well as the more common ones, and both to prevent and to treat most of them. There, drugs, apparatus and assistants are present in abundance. Patients are adequately premedicated so that their fears are allayed. They are operated on while recumbent, are given a high percentage of oxygen, and may be carried as deeply as necessary without thought of immediate postoperative ambulation. Tracheal intubation is employed as often as indicated. These many factors together combat anoxia, and represent for the patient safeguards against the need for emergency treatment.

In the private oral surgery, however, space limitations restrict the variety of drugs and equipment available. Furthermore, drugs and rubber anesthetic equipment for emergencies may be kept on hand unused for several years, until their location becomes obscure and their condition deteriorated. A rare emergency could arise suddenly to catch the oral surgeon and his assistants unprepared in plan as well as materials. When the anesthetist is not a physician, the oral surgeon, himself, is ultimately responsible for the recognition of the developing emergency and for its management.

A review of emergency treatments, then, is valuable, especially if emphasis is placed on recognition of the various types, the drugs needed and the specific corrective measures to be applied.

The exigencies that may arise in both major and minor oral surgeries are so diverse that classifying them is somewhat arbitrary. They may be taken up according to organ systems, with the realization that some evolve from the patient's faulty physical status, others from miscarriage of the effects of professional services (iatrogenic causes).

■ *Endocrine Emergencies*

DIABETES MELLITUS—Oral and other infections in persons with diabetes are dangerous because they increase the demand for insulin and thus lead to diabetic acidosis, progressing to coma. Diabetic acidosis is manifested by headache, irritability, drowsiness, hyperpnea and fever. The sweetish odor of acetone may be detected on the breath. The blood pressure is lowered, and the pulse is rapid and thready.[3]

Immediate treatment is required in a hospital, but if there is any delay, the patient should receive an intravenous infusion of 1,000 cc. of 5 per cent glucose in normal saline solution to which has been added 50 units of regular insulin. In the hospital, the patient will need careful supervision of his disease by a physician over a period of several days; and the best time to perform the surgical procedure probably will be when his diabetes has been brought under control. The giving of glucose in the presence of suspected hyperglycemia is rational, since the

3. Chatton, M. J., and others. Handbook of medical treatment, ed. 3. Los Altos, Calif., Lange Medical Publications, 1953.

store of liver glycogen is lowered, and besides a temporary increase in blood sugar is of little moment.

Rarely, a waiting patient will display the effects of hypoglycemia due to hyperinsulinism, or to overdose of insulin in the diabetic. Missing a meal or getting too much exercise may precipitate the condition. The patient will have weakness, hunger, irritability, and tremors, progressing to convulsions. Consciousness is sometimes lost. Prompt improvement is brought about by the slow intravenous injection of 50 cc. of 50 per cent glucose solution.

THYROID DISEASE — Hypothyroidism causes increased susceptibility to premedication and anesthetic agents, so that resuscitation may be required for a considerable period after general anesthesia unless low doses and weak agents have been administered. The patients should be recognized by their weakness and easy fatigability, their anemic, puffy, dry skin and their sparse, dry hair.

Hyperthyroidism can cause more acute emergencies. Patients with this condition look alert, and their movements are quick. They show weight loss, nervousness and a fine tremor of the fingers. The skin is hot, moist and flushed. If a patient with a severe hyperthyroid condition is given a simple gas-oxygen anesthesia, a serious anoxic episode will be precipitated, with permanent brain damage or cardiac arrest. These patients require premedication, preferably including sedation at bedtime the night before, repeated in preparation for the trip to the office. An hour before the anesthesia, some appropriate narcotic should be given, such as morphine or meperidine hydrochloride. If nitrous oxide is chosen for the anesthetic, it should be given with an abundance of oxygen and should be fortified by the addition of trichloroethylene or other potent agent.

Some of these patients are so near exhaustion that the combination of travel, oral surgical procedure and anesthesia might overtax their hearts, and these should be studied promptly by a thyroid surgeon so that their excessive production of thyroid hormone may first be brought under control. The decision must be made whether to perform the oral surgical procedure ahead of the thyroid surgical procedure or after. Suppression of function with propylthiouracil and strong iodine solution (Lugol's solution) may be effective for only two weeks, and may necessitate placing the thyroid operation first.

Thyroid crisis has become rare with modern forms of therapy. It is a possibility immediately after extirpation of the gland, and is then treated with cortisone, sedation and cold packs.

Substernal goiter may cause tracheal compression during general anesthesia. A patient with considerable enlargement might best have the oral surgical procedure carried out under local anesthesia. If the work to be done is not too urgent, a thyroidectomy might be performed first.

■ *Central Nervous System Emergencies*

CONVULSIONS—A grand mal epileptic convulsion may occur in the office. The sufferer should be protected from injury during the fall. The tongue is frequently bitten, and this biting sometimes can be prevented by use of a stack of tongue blades or a mouth prop. A Yankauer suc-

tion tip may be employed for removal of mucus obstructing the breathing. The usual attack is self-limited and requires no drug treatment.

In status epilepticus, the attacks keep recurring rapidly, causing exhaustion or death. A good treatment is paraldehyde, 1 or 2 cc. in triple the volume of normal saline solution, injected slowly intravenously. If ineffective, the dose should be repeated. Such a patient should afterward be put under the care of a medical general practitioner or internist.

For a local anesthetic convulsion, 1 or 2 cc. of 2.5 per cent thiopental sodium[4] or 20 units of curare (3 mg. of d-tubocurarine) should be given intravenously, according to Apgar.[5] These small doses are usually adequate, but if not, more drug must be administered. Apnea and circulatory depression resulting from the treatment are to be expected. Without the anticonvulsant, the patient would continue to hold the trunk in rigid forced expiration so that efforts to overcome anoxia by oxygen administration or chest compression would be futile. With the relaxation due to the anticonvulsant, oxygen may be given effectively by mask and bag, with rhythmic, manual bag compression. The patient's carbon dioxide must be eliminated efficiently. Circulatory collapse should be watched for and corrected by slow infusion of a solution containing a vasoconstrictor.

Since local anesthetics, especially cocaine, have been responsible for convulsions, it is wise to premedicate with a barbiturate, and limit both the strength and the dose, of the local anesthetic agent, administering the weak solution slowly and watchfully. Other causes of convulsions are carbon dioxide retention, oxygen lack and hyperthermia.

CEREBRAL ANOXIA—Cerebral anoxia occurs whenever the transport mechanism for oxygen breaks down at any point. Cyanosis, failing pulse, apnea, wide dilation of pupils and many other signs warn of the condition. The anesthetic agent should be discontinued for the time being, and large volumes of oxygen should be employed to ventilate the lungs. Other measures are described throughout this paper. During the recovery period, oxygen is beneficial when given by nasal catheter at a rate of about 5 liters per minute for several hours.

Cerebral anoxia sometimes causes cerebral edema, which can be reduced by substances which increase the osmotic pressure of the blood. Dextran, 20 per cent, is employed by Lundy[6] in this way, as an intravenous infusion, in doses of 80 to 100 cc. to adults. The circulation of the brain may be improved by an intravenous injection of caffeine and sodium benzoate, 7½ grains.

HYPERTHERMIA—Hyperthermia with a fatal outcome may occur spontaneously during extremely hot weather, particularly in the older, overweight person with circulatory disease. If the body temperature under such circumstances goes above 105°F., accompanied by prostration and tachycardia, packing in ice may become

4. Clement, F. W. Nitrous oxide-oxygen anesthesia, ed. 3. Philadelphia, Lea & Febiger, 1951, p. 149.

5. Apgar, V. Management of anesthetic emergencies. In Anesthesiology by forty American authors. Philadelphia, F. A. Davis Co., 1954.

6. Patrick, R. T., and Lundy, J. S. Emergencies in course of anesthesia. In Emergency surgery, Ficarra, B. J., editor. Philadelphia, F. A. Davis Co., 1953.

necessary until the rectal temperature approaches normal. Previous prolonged sweating may result in a concomitant state of salt depletion, making the intravenous administration of a liter of normal salt solution advisable.

When a patient is to be operated on during hot weather because of a severe infection with fever, a dangerous situation is created. The possibility that anesthetic agents, particularly ether, can contribute to the derangement of the already overtaxed heat-regulating center must be considered. Preoperative dehydration and depression of the sweating mechanism by atropine may send the body temperature to such heights during the operation that death in hyperthermia with convulsions results. Heavy draping is to be avoided. The child's susceptibility to convulsions makes him an easy victim.

■ *Respiratory Emergencies*

RESPIRATORY DEPRESSION — Respiratory depression may range from a mild form needing no treatment other than the reclining position without a pillow for a period of time, to apnea, recoverable from only through resuscitation. Cardiac arrest causes apnea. Apnea is brought on by nitrous oxide-induced asphyxia and by overdose of other anesthetic agents. Reflex apnea, or breath-holding, develops when anesthetic vapors in irritant concentration are administered. It is seen, along with laryngospasm and often with gagging, when foreign substances lodge in the respiratory tract at the oropharyngeal level or below.

Overdose of general anesthetic agents is associated with medullary depression, manifesting itself in peripheral vasodilation with hypotension, and weakening or abolition of respiration. Muscle relaxants such as curare, decamethonium bromide and succinylcholine chloride contribute to these effects. Sometimes overdosing is done in an effort to stop a convulsion or to end a severe laryngospasm, and may be justifiable. A limpness results, with a relaxation of the tongue which shuts off the hypopharynx. Insertion of a Guedel airway in the mouth is helpful in overcoming this obstruction.

Fig. 1—Makeshift artificial respiration of patient overdosed with anesthetic

While oxygen-giving apparatus is being adjusted, severe anoxia sometimes may be averted if the sternum is pressed on rapidly and repeatedly by the fingertips, while a listening ear is held in close proximity to the patient's mouth as a check on the effectiveness of the method (Fig. 1). Little would be accomplished by this manipulation in the alert patient, but it has a stopgap utility for the victim of respiratory collapse. These persons are very relaxed, and at the same time their metabolic rate is so depressed that the

Fig. 2—Manual relief of obstruction at hypopharynx (subluxation of the jaw)

minimal ventilation so produced is more effective than might at first appear.

If a mechanical airway is not available immediately, the obstruction of an atonic, prolapsed tongue may be resolved: (1) by turning the patient so that his mouth points sidewise and downward; (2) by tugging on the tongue with the fingers covered by cloth or (3) most simply by subluxating the mandible while the mouth simultaneously is held open (Fig. 2).

Analeptics, restoratives, stimulants, drugs which could reverse the depression of narcotic and anesthetic overdose, have long been sought. Many have been widely used, such as picrotoxin, strychnine, pentylenetetrazol, nikethamide, and succinate. There is no analeptic that can be considered ideal.

When the mainstays of resuscitation are included, that is, oxygen administration, artificial respiration and the giving of intravenous fluids, then the analeptics sometimes are of assistance. The tendency of many of them to cause convulsions limits their value. Anesthesiologists often object to their widespread use because many of the analeptics increase the metabolic rate of the tissue cells, sometimes beyond the capacity of the transport system to deliver enough oxygen to fulfill the stepped-up requirement. Some, particularly the antagonists of the muscle relaxants, are effective for one type of relaxant, but deepen the paralysis caused by another type. The narcotic antagonists, nalorphine hydrochloride (Nalline) and levallorphan, were found useful by Landmesser, Formel and Converse[7] in combating opiate-induced respiratory depression, but they prolonged depression from barbiturate overdose.

In practice, the tendency of many anesthesiologists is to rely but little on stimulants or analeptics, and bend every effort to avoid anesthetic overdose and anoxia. The analeptics are most noticeably effective when used to awaken the inebriated or stimulate the attempted suicide who has ingested an overdose of barbiturates.

On the operating table, at the end of the surgical procedure, intravenous caffeine and sodium benzoate will often clear up a mild respiratory depression, and on the recovery couch a cup of coffee will often brace the patient for the trip home, if he is groggy after intravenous barbiturate anesthesia. Caffeine is one of the safest drugs in the pharmacopeia, virtually never producing convulsions, reversal of desired effect, or a sensitivity reaction, such as the others sometimes do.

7. Landmesser, C. M.; Formel, P. F., and Converse, J. G. Effects of new narcotic antagonist (levallorphan tartrate). anesthesiology 16:520 July 1955.

RESPIRATORY OBSTRUCTION—Respiratory obstruction may take place at the nares beneath the nasal inhaler, in the nasal cavity, at the soft palate, at the tongue, the epiglottis, the vocal cords, the trachea, the bronchi, and in the alveoli. Improper functioning of the gas machine also causes obstruction to respiration, arising from sticking valves, kinked tubing and insufficient flow of gas.

Treatment varies with the cause and location. A lubricated nasopharyngeal airway may be inserted to overcome some nasal and palatal obstructions, if infection is not the cause. Often, shrinkage of the nasal mucosa with a spray or drops of antazoline hydrochloride-naphazoline hydrochloride or similar preparation is all that is required.

The need for careful insertion of the oral pack so that the base of the tongue will not be jammed against the posterior pharyngeal wall is well understood.

Vomiting usually can be avoided by smoothly maintained anesthesia of sufficient depth. If it occurs, the patient must be made to lean forward in the chair, and the suction tip must be used freely. Suction apparatus used in connection with general anesthesia should produce strong negative pressure and be capable of removing large volumes of liquid vomitus quickly from the hypopharynx. Millhon[8] states that the ordinary aspirator on dental units is inadequate for removing the mucus which sometimes develops during thiopental sodium anesthesia.

A laryngoscope is a valuable emergency instrument for the oral surgery, apart from its use for tracheal intubation. It is sometimes employed along with forceps for picking up tooth fragments or regurgitated particulate matter lodged in the hypopharynx. It assists on occasion in the process of suctioning blood and mucus by catheter from this region and from the trachea.

Food particles, chewing gum, blood and portions of teeth can enter the larynx and cause intense laryngeal spasm, indicating in some instances the need for the supine head-down position coupled with intravenous administration of barbiturate anesthesia; or atropine, 1/150 grain; or a muscle relaxant such as succinylcholine chloride, 10 mg. The resulting relaxation of the cords makes possible the effective administration of oxygen. If the foreign matter is not retrieved, it may plug one or more bronchi and lead to atelectasis and even lung abscess unless bronchoscopy is performed, with suction and perhaps the lifting out of particulate matter.

Bronchospasm produces musical rales, as typified by bronchial asthma. Epinephrine, 1:1,000, 0.2 to 0.5 cc. subcutaneously is the treatment of choice. Lundy uses the intravenous route. Diphenhydramine hydrochloride, 25 to 50 mg., intravenously, may help. It may be necessary to resort to aminophylline solution, 10 cc., 3¾ grains which should be administered slowly by vein. Ether inhalation dilates the bronchi and relieves the asthmatic attack.

Allergic laryngeal edema is capable of causing severe obstruction in the rare patient, requiring relief by a few minims of epinephrine 1:1,000 given cautiously subcutaneously. The frequent presence of swollen lids and giant hives of the skin

8. Millhon, J. A. Pentothal Sodium anesthesia for dental surgery in office practice; review of 3,434 cases. Anesth. & Analg. 29:163 May-June 1950.

assists in diagnosis. ACTH or cortisone usually may be relied on, in severe cases. In the rare fulminating obstruction, refractory to drugs, tracheotomy has been resorted to.

Tracheal intubation is sometimes employed for relief of mechanical and reflex obstructions of the larynx, and for apnea. When spasm is a factor, the method is apt to fail or to result in much trauma; therefore, intravenous medication for the relief of the spasm is the key to the situation. The method of introducing oxygen below the obstruction by piercing of the skin and cricothyroid membrane with a large hollow needle, through which oxygen is then blown, has its adherents, but great attention to detail is necessary if overinflation and rupture of delicate structures in the respiratory tract are to be avoided.

Ludwig's angina in time causes laryngeal edema going on to complete obstruction. Extension of severe infection in the floor of the mouth and down the neck is evident, and the stiff carriage of head and neck, coupled with anxiety and weariness, are typical. Sedation, analgesics and anesthetics, if given, are apt to relax the tired muscles of the larynx and pharynx and produce total obstruction within a few minutes. Hospitalization and emergency tracheotomy under local anesthesia are mandatory, together with drainage of the abscess and administration of oxygen and antibiotics.

Treatment of mandibular fractures can lead in several ways to respiratory obstruction, if general anesthesia is employed. Wiring of the teeth obstructs the oral passageway, but when it can be accomplished without anesthesia, is seldom dangerous. When wiring is done under general anesthesia, the stomach must be quite empty of food even if this necessitates postponement of the operation. Vomiting during recovery may still occur, but with vigilance the simple liquid material reaching the hypopharynx may be removed quickly by nasal catheter and suction.

Some patients with wired teeth, particularly the heavy-set, snore to such a degree after general anesthesia that they develop edema of the soft palate and base of the tongue. Asphyxia results unless a nasopharyngeal airway is passed.

Bleeding from passage of the tube can be avoided if antazoline hydrochloride-naphazoline hydrochloride or other mucosal vasoconstrictor is employed first. The tube will be tolerated long enough for the waking period to be attained if it is first coated with 5 per cent lidocaine ointment or other equally effective topical anesthetic agent. Fowler's position is valuable in reducing nasopharyngeal obstruction due to congestion and edema.

Vomiting during the recovery period of anesthesia usually may be avoided by the intramuscular injection of two or three doses at three hour intervals of cyclizine lactate, 50 mg. It is well to give the first injection during the operation, a half hour before the expected closure.

■ *Circulatory Emergencies*

HYPOTENSION—Hypotension as seen in the office is associated with hot weather, fatigue, simple fainting connected with fear, intravenous anesthesia, the central toxic effect of local anesthetic agents, and poor stress response. Vasodilatation usually causes the hypotension, the vasomotor

center in the medulla being affected by adverse reflexes, fatigue, or depressing drugs.

The Trendelenburg position aids venous return of blood to the heart, filling that organ properly between beats, and it favors the flow of arterial blood to the brain. Further treatment may be necessary in the form of an intravenous infusion containing a vasopressor. The fluid selected may be a liter of 5 per cent glucose in water or normal saline solution, and the vasopressor added to it may be methoxamine hydrochloride, 20 mg.; levarterenol bitartrate, 1:1,000, or phenylephrine hydrochloride, 4 mg. Patients with refractory conditions, and particularly the poor risks in the hospital surgery, need a plasma volume expander such as 500 cc. of dextran, or even one or more blood transfusions, to which, perhaps, a vasopressor has been added.

Salassa and others[9] have called attention to the depression of adrenal cortical function which sometimes results for as long as a year, from the administration of a course of ACTH or cortisone. These persons may go into irreversible shock within the 24 hour period after any stressful experience, whether it be accident, anesthesia, or operation. In spite of intravenous fluid therapy with vasopressors and plasma expanders, the arterioles dilate, the capillaries exude plasma into the tissues, and death occurs. Adrenal cortical hormone must be included in the treatment.

Heretofore, success has followed the intravenous administration of a liter of normal saline solution to which has been added 25 or 50 cc. of aqueous adrenal cortical extract, along with 4 mg. of levarterenol. In addition, 200 mg. cortisone intramuscularly and 200 mg. orally are administered. Now, an improved drug is available in hydrocortisone hemisuccinate sodium, prepared in single dose vials of the powder. This is readily dissolved in 2 cc. of sterile water, and may be injected intravenously over a period of 60 seconds, with prompt improvement in the blood pressure. Half doses (1 cc.) should be repeated after one, three, six and ten hours.

It is best to ask every new patient whether or not he has received previous ACTH or cortisone therapy in the past year. Patients to be specially interrogated are those with arthritis, asthma, other allergies and skin diseases. This refractory shock state after operation is apt to come on in the home; this fact indicates a long delay in treatment. Prevention is safer and simpler, with administration of cortisone, 200 mg. intramuscularly two days before the surgical procedure, repeated one day, and again, one hour before. After the surgical procedure, the preventive treatment is continued daily for four days with diminishing doses.

There is no question but what many patients, previously on treatment, escape this severe shock state even without the administration of cortisone. However, protection is most likely to be needed for those who have had five or more days of cortisone therapy in the past three or six months, and particularly if a major surgical procedure is contemplated.

The arteriosclerotic patient should not be sent sent home from the office soon after a barbiturate anesthesia in hot

9. Salassa, R. M., and others. Postoperative adrenal cortical insufficiency; occurrence in patients previously treated with cortisone. J.A.M.A. 152:1509 Aug. 15, 1953.

weather, unless he may recline in transit. Dependent vasodilatation in the upright position is capable of reducing blood pressure in these persons until the impaired circulation of the brain and heart becomes grossly inadequate, possibly with a fatal outcome. The hospitalized arteriosclerotic patient should be kept overnight after anesthesia with cyclopropane, ether, or barbiturate and muscle relaxant, unless the ambulance is used.

HYPERTENSION — Hypertension is looked for in the overweight, plethoric person, the thyrotoxic person, anyone with evidence of arteriosclerosis, and in a patient complaining of intense, throbbing headache. Unexpectedly, the sufferer may be thin and pale. The sphygmomanometer should be employed frequently so that instances of the condition will not be missed. An unbridled rise in blood pressure to an unaccustomed very high level may result in apoplexy or pulmonary edema. If the danger seems real, it may be necessary rarely to give oxygen and break a pearl of amyl nitrite in the bag of the gas machine, for inhalation. Sodium nitrite solution, 1 to 3 grains, may be cautiously injected intravenously.

A reflex elevation is possible in hypertensive persons during light intravenous anesthesia. Nitrous oxide anesthesia given in a manner to produce anoxia will cause a rise. More often, anesthesia with any agent will cause vasodilatation and a lowering of blood pressure. In the hypertensive person, this can occasionally be so precipitous as to cause cerebral or coronary thrombosis. The mild, head-down position, oxygen therapy, and even a vasopressor given cautiously will avoid one of these hypotensive accidents.

The average person with hypertension probably will endure the anesthesia and surgical procedure with least morbidity if his blood pressure is maintained as closely as possible at its accustomed level.

HEART DISEASE—Patients with heart disease usually give a detailed account of their condition with a little prompting. Physical examination reveals such signs as cyanosis, dyspnea, dependent edema, arrhythmia, cardiac enlargement and hypertension. If extensive surgery with general anesthesia is contemplated and serious cardiac disease is found or suspected, the patient first should be referred to an internist for treatment, and the latter's advice as a consultant should be followed.

Whether the patient should be admitted to the hospital for surgery; whether orthopnea exists, ruling out the supine and the head-down position; whether the patient will be treated with digitalis, making use of cyclopropane dangerous; whether much lowering of blood pressure can be tolerated; whether nerve blocks should be used to supplement general anesthesia and thus reduce the dose of the latter, and whether a vasoconstrictor should be used in the regional anesthetic solution are important considerations. The right answers to these questions will eliminate many crises before they develop.

Many authorities traditionally are lined up against inclusion of vasoconstrictor agents in local anesthetic solutions for use in hypertensive and arteriosclerotic patients and for those with angina pectoris and thyrotoxicosis. Salman and Schwartz[10] injected several local anesthetic solutions containing various vasoconstrictors in

common use into a series of patients with cardiovascular diseases and into control patients, without untoward effect. Perhaps their series was too small. Certainly, if vasopressors are used in such situations, the concentration must be made the lowest possible that will limit diffusion, because the chief excuse for their employment in these instances is to prevent toxic central action of the local anesthetic, which might be equally disastrous in the patient with cardiovascular disease.

Millhon[8] gives all patients with known heart disease 100 per cent oxygen through the nasal inhaler for at least a minute prior to induction with thiopental sodium. The patient with a history of angina pectoris is asked to allow a 1/100 grain nitroglycerine tablet to dissolve under the tongue on entering his office.

In spite of the prophylactic measures, an anginal attack may develop, with substernal pain and perhaps radiation to the arm. Relief may be brought about with a second nitroglycerine tablet under the tongue, or perhaps by amyl nitrite, administered with oxygen, the pearl being broken in the bag of the gas machine.

At onset, acute myocardial infarction may be indistinguishable from angina pectoris, but severe pain persists and shock is likely to supervene. The pain requires intravenous morphine, 1/6 or 1/4 grain, for relief, and sometimes the dose must be repeated. Meperidine hydrochloride, 100 mg., is preferred by some. The victim must be allowed to recline and lie in whatever position is most comfortable, and he requires oxygen. Further expert management by an internist is in order.

CONGESTIVE HEART FAILURE — Occasionally a patient is seen in congestive heart failure of such sudden onset and severity that the decision is made for digitalization as rapidly as possible. This rapid treatment is hazardous, and should be reserved for the patient whose continued existence is being threatened by shock with tachycardia, dyspnea, and cardiac dilatation, even, perhaps, with the appearance of pulmonary edema.

Rapid digitalization may be accomplished by the intravenous injection within a period of a few minutes of lanatoside C in a dose of 0.8 to 1.6 mg., according to Lundy.[6] If this fails to slow and strengthen the heartbeat within a half hour, a beginning should be made on cautious administration of a repeat dosage. The attempt to digitalize so quickly is fraught with danger, and should be discontinued if it brings on signs of overdosage such as nausea and disorientation, for otherwise it may lead to heart block or ventricular fibrillation. These patients require oxygen, also.

According to the *Handbook of Medical Treatment*,[3] the procedure of rapid digitalization with lanatoside C should be to give 6 cc. (1.2 mg.) intravenously, followed by 2 cc. every three to four hours until digitalization is obtained (slowing of tachycardia, improvement of blood pressure and relief of breathlessness).

ACUTE PULMONARY EDEMA—Patients with mitral stenosis and failure of the left side of the heart, and decompensating hypertensive patients, may develop acute pulmonary edema. Congestion in the pulmonary capillaries leads to exudation into

10. Salman, I., and Schwartz, S. P. Effects of vasoconstrictors used in local anesthetics in patients with diseases of the heart. J. Oral Surg. 13:209 July 1955.

the alveoli. Pink froth fills and obstructs the bronchi and compels the victim to sit up and gasp for breath. Faulty anesthesia allowing persistent inspiratory obstruction may lead to this dangerous condition. Emergency measures are required if a fatal outcome is to be avoided.

Morphine sulfate, 1/4 or 1/6 grain, is administered by vein with much benefit. The same treatment, however, is very harmful in bronchial asthma, which must be differentiated. Oxygen is given by a tightly fitted mask with the exhalation valve set so that the gas bag remains slightly distended even during inspiration, but the positive pressure should not be enough to impair ventilation.

The circulating blood volume must be reduced to afford relief in some instances. Tourniquets applied so as to congest all four extremities will usually accomplish this. A pressure of about 50 mm. of mercury is used. The tourniquets should be released in turn, one at a time, every half hour. Withdrawal of a half pint or more of blood is sometimes resorted to. Fowler's position is helpful. Inhalation of alcohol vapor with oxygen by nasal catheter is beneficial. The oxygen is bubbled through 95 per cent alcohol.

CARDIAC ARRHYTHMIAS—Pre-existing cardiac arrhythmias of various sorts are associated with rheumatic heart disease, hypertensive cardiovascular disease, chronic myocarditis, thyrotoxicosis, cardiac neurosis, and other states. They frequently point to low cardiac reserve, and suggest unusual vigilance during the operation.

Developing under anesthesia, arrhythmias may be the forerunner of cardiac arrest, particularly if bouts of premature ventricular systoles or ventricular tachycardia occur. Only the electrocardiogram can identify arrhythmias with certainty, and if a serious form is suspected, it must be treated as such when the instrument is not available. Dangerous irregularities are likely (1) in deep cyclopropane or trichloroethylene anesthesia; (2) whenever anoxia develops and (3) when the myocardium is irritated by epinephrine, whether due to excitement, adrenal tumor, or local injection by the surgeon.

Fear must be eliminated through premedication, suggestion, and gentleness of manipulation. Anoxia must be avoided at all times. If cyclopropane or trichloroethylene is being used when arrhythmia develops, anesthesia is lightened to the point at which the irregularity ceases. Supplementation with ether or intravenous anesthesia is beneficial.

It may become necessary in extreme emergencies of ventricular paroxysmal tachycardia for quinidine hydrochloride to be infused intravenously very slowly by drip, a 10 cc. ampule, 0.6 Gm. being diluted to 250 cc. in 5 per cent glucose in sterile distilled water for the purpose. This arrhythmia is characterized by fairly regular fast pulse rate of 150 to 180 per minute. Without an electrocardiogram, auricular paroxysmal tachycardia is indistinguishable, and if it is causing severe dyspnea and distress, it may be treated the same way.

Sometimes reflex vagal inhibition of the heart is back of an arrhythmia, with bradycardia and lowering of blood pressure in evidence or even asystole. Reduction of vagal influence is accomplished by slow intravenous injection of atropine,

1/150 to 1/75 grain in the adult. Premedication with atropine or scopolamine before general anesthesia is desirable if only to avoid vagal inhibition of the heart.

CARDIAC ARREST—The heart may stop because of vagal overactivity. It usually resumes its beating after a few seconds, but not always. Rapid absorption of cocaine into the circulation has caused many cardiac arrests, and other local anesthetic agents also have been implicated. Many deaths from cardiac arrest have resulted during induction of terror-stricken, unpremedicated patients with either chloroform or cyclopropane. The permitting of anoxia to develop during the administration of any kind of anesthesia subjects the patient to the threat of cardiac arrest.

The anesthetized patient suddenly turns ashen and pulseless. Although this may mean the onset of reflex shock, from which the patient perhaps would recover spontaneously, it may instead signal cardiac arrest. If gentle palpation of a carotid artery and auscultation of the heart corroborate the negative evidence from palpation of the radial artery, the diagnosis must be made flatly and acted on with dispatch. It becomes the surgeon's duty immediately to incise the chest wall in the fifth left costal interspace or thereabouts, and commence rhythmic manual cardiac compression. Time is so vital that none of it can be wasted in special efforts at asepsis or hemostasis. The intercostal vessels, coursing just below the upper rib, should be avoided, as should also the internal mammary artery, ¼ inch lateral to the sternum. The costal cartilages of the two ribs bordering the incision are cut across, which gives the hand more room.

The pleura must be incised carefully, whereupon the left lung will fall away, or may be retracted sufficiently so that it will not be incised inadvertently. The pericardium need not be incised, but if it is, the coronary vessels must be carefully avoided. The heart must be examined visually, and felt for signs of quivering or fibrillation, which gives the impression of a bag of writhing worms, because selection of drugs for injection into the cavity of the left ventricle depends upon this point. The anesthetist must administer oxygen by rhythmic manual gas bag compression during this time, as will be described later, and he should keep a check on the pulse, blood pressure and any spontaneous respiratory activities of the patient.

If the heart is in ventricular fibrillation, it must be rendered less irritable with several cubic centimeters of 1 per cent procaine hydrochloride solution, injected in the left ventricular cavity, and the dose may need to be repeated before fibrillation will cease. If an electric defibrillator is at hand, it should be employed to shock the heart into quiescence. A 0.1 second shock utilizing 2.5 amperes of current will usually suffice, if repeated several times.[11] Meanwhile, the rhythmic manual pumping of the heart is continued at about 60 artificial beats per minute. Only a very low blood pressure can be generated in this way, but it can be reinforced to oxygenate the vital tissues of the brain and myocardium better if the aorta just below the arch is kept compressed most of the time.

11. Los Angeles County Heart Association. Cardiac resuscitation committee. Program of action. Cardiac resuscitation. Los Angeles, Los Angeles County Heart Association.

It is imperative that the collapsed blood pressure be raised effectively by an intravenous infusion of 5 per cent dextrose in distilled water containing a vasoconstrictor such as methoxamine hydrochloride, 20 mg. per half liter or liter. This may need to be flushed into a vein to begin with through a large needle such as an 18 gauge, and then dripped at a slower rate, once adequate blood pressure has been established. If a major operation is in progress, the needle may already be in place. If not, it must be inserted at once. Failing that, a cut-down on a vein, with insertion and tying in of a cannula, becomes of vital importance.

The heart when first seen may be discovered in asystole—dilated, flabby and ominously quiet. This kind of heart needs stimulation with epinephrine, about 0.3 cc. of 1:1,000, diluted in 10 cc. normal saline solution, injected into the cavity of the left ventricle.

Drugs for the left ventricular cavity may be administered by sterile 10 cc. syringes bearing 22 gauge needles from 1½ to 3 inches long. The equipment for this needs to be autoclaved and kept available. Syringes and needles in antiseptic solution are unsatisfactory because the antiseptic may destroy the drug to be injected, and it may fail to kill the virus of infectious hepatitis, permitting dissemination of the disease.

Nothing may be left to chance in the administration of oxygen as a part of the program of revivification in instances of cardiac arrest. Appropriate equipment in working order must be in readiness against the day when it suddenly may be called on. Periodic inspections will disclose deterioration of rubber parts and other defects in time for replacements to be made.

A chart on cardiac resuscitation might be kept handy. A useful one on a "Program of Action. Cardiac Resuscitation" has been prepared by the Los Angeles County Heart Association.[11]

The nasal inhaler is inadequate for these grave crises. In the major surgery, the anesthetic machine with soda lime for absorption of carbon dioxide will be found satisfactory. There, a selection of several sizes of rubber face masks with inflated rims is at hand. One of the lot will fit the particular face, and may be sealed in a leakproof manner by a combination of a carefully adjusted four-tailed head strap with skillfully applied manual pressure. The hand not holding the mask compresses the gas bag intermittently, inflating the lungs with oxygen. The carbon dioxide is extracted from the breath by the soda lime.

Carbon dioxide absorption is seldom available in the private office. Good resuscitation may be performed here by use of a well-fitting rubber mask and a head strap as just mentioned, with a system of nonre-breathing valves such as the Fink modification of the Slater-Stephen valve (Fig. 3). Manual pressure on the breathing bag closes the exhalation port automatically and propels oxygen down the trachea to inflate the lungs. Cessation of squeezing on the bag releases the exhalation valve and allows the patient's expiration with its burden of carbon dioxide to be discharged into the room. Resuscitation may be carried out for hours in this way with a minimum of fatigue. A flow of better than 5 liters of oxygen per minute is needed.

A fair substitute may be had in a

simple mask and bag setup with the two parts joined by a plain chimney piece (Fig. 4). This will permit dangerous accumulation of carbon dioxide in the patient's tissues unless the anesthetist takes care to lift the mask after every lung inflation. This procedure will allow for the escape into the room of the succeeding expiration.

The McKesson face mask with corrugated tubing is safe for resuscitation only insofar as the operator can guarantee to close digitally the exhalation valve on the chimney piece with each compression of the gas bag, thus insuring a good inflation of the lungs. A Heidbrink four-tailed head strap and hook-ring will secure the mask to the face better than the McKesson halter can do it.

The most leakproof fit for instances when the chest is open is provided by a tracheal tube with inflated cuff. Carbon dioxide absorption or some valve system must be provided, the same as when a mask is used. Ventilation temporarily is abandoned while tracheal intubation is being performed, and thus a well-functioning mask setup may lead to indefinite postponement of intubation. However, the possibility that gastric contents may enter the bronchi while the mask is being utilized must be considered.

If, with employment of these measures, the heart is reached and made to beat artificially within three minutes of its arrest, chances are good that at least a fair degree of recovery will take place. A restless postoperative course can be expected, requiring hospitalization and private nursing care around the clock. The heart may need repeated compression for a half hour or more, coupled with drug treatment, before it will resume full regular beating.

Fig. 3—Fink-Slater-Stephen valve in use for artificial respiration

Closure of the chest must be given attention. It is advisable that a general surgeon or chest surgeon, or a surgical resident, should be called to the operating room to effect the closure. In any case, bleeders appear as blood pressure rises, and are to be clamped and ligated. The ribs bordering the incision are brought toward each other and held in normal proximity by strong cotton or silk threads placed around the ribs, in order that an air-tight closure of the pleura and intercostal muscles may be accomplished. A Foley catheter or other drain should be inserted and stitched in place.

When closure is finished, the lungs are inflated by positive oxygen pressure applied by the gas machine, and when the left pleural space has been obliterated in this way, the drain is either plugged or clamped off, to be connected later by a

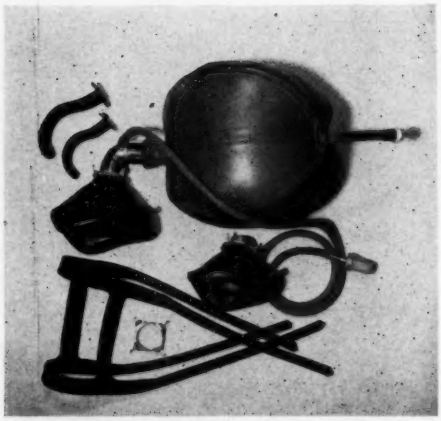

Fig. 4—Adjuncts to gas machine for efficient use of artificial respiration

hose to a water-vacuum bottle beneath the bed. Antibiotics such as penicillin with streptomycin or chlortetracycline will be required in the pleural space and later intramuscularly.

■ *Other Emergencies*

VOMITING OF FOOD—Some oral surgeons, including Millhon,[8] prefer not to have their patients fast preceding intravenous anesthesia and surgery. Hubbell[12] has observed that dental patients who have fasted for long periods before anesthesia more often have prolonged recovery time. Advice to eat, however, sometimes will be given to those who are easily upset emotionally and to those with overactive vomiting reflexes. These people are refractory to anesthesia when their stomachs are full, and they hold the rib cage rigid, form excessive mucus, and develop laryngospasm. Emesis may occur during anesthesia with aspiration into the bronchi of acid stomach contents, bacteria, and perhaps food particles. Preanesthetic abstinence from food and drink should be insisted on, thus circumventing many a complication of anoxia and pneumonia.

In patients with trauma who require surgical procedure, the process of digestion may be stopped by the accident, leaving partially digested food in the stomach for hours. If this situation is suspected, it is proper to induce vomiting before anesthesia by the passage of a large stomach evacuator tube, or to persuade the patient to gag. As an alternative, operation may be postponed for several hours.

GASTRIC INFLATION—The stomach is sometimes inflated by too vigorous compression of the gas bag during a period of laryngospasm or breath-holding on the part of the anesthetized patient. The abdomen becomes noticeably rotund and drumlike when percussed over the upper left quadrant. The complication would be more common were it not for the fact that under anesthesia no matter how severe the laryngospasm, the cricopharyngeus muscle, guarding the entrance to the esophagus, almost invariably holds tighter than the muscles pressing the cords together.

When distention is produced, it should be alleviated immediately by passage of a large stomach tube, because, if allowed to remain, it sets up reflex shock and hampers respiration by a splinting action. A Levine tube is not easily passed in the uncooperating patient because of the tonus of the cricopharyngeus muscle, which causes the slender tube to buckle and coil up. This type of tube, however, may be pushed down with the aid of a

12. Hubbell, A. O. Pentothal Sodium anesthesia for dental surgery in office practice and control of recovery time. Anesthesiology 4:174 March 1943.

laryngoscope and a Magill forcep in the deeply anesthetized patient, or with the aid of two fingers curved over the tongue and used as a guide for the tube, in the lightly anesthetized patient.

VENIPUNCTURE FAILURE—Extravasation of anesthetic barbiturate solution may produce a painful swelling or even a slough. Here, as in the case of other complications, concentration on prevention pays the highest dividends. After insertion in a vein, the point of the needle should not be left to press against the wall, where it may perforate at any time, but should be made to come to rest in midstream. Various refinements in technic help in the accomplishment of this purpose, such as pointing the bevel of the needle downward, or employment of Huber needles or eccentric tip syringes. A close watch should be kept on the skin just proximal to the point of entry of the needle, so that the injection may be stopped at the first sign of tumefaction. The elbow should be straightened if the needle is to be inserted in the cubital region. Keeping the dilution of barbiturate solution at 2 per cent or below renders it only mildly irritating.

If an extravasation of considerable magnitude takes place in spite of all precautions, an injection of 1 per cent procaine hydrochloride solution may be made in and about the region, in order to dilute the irritant and relieve the local reflex angiospasm. Hot packs are recommended.

An intra-arterial injection is sometimes made inadvertently, usually in the brachial artery at the elbow, and this elicits severe cramping pain in the hand. A large volume of concentrated barbiturate solution so injected will cause gangrene of the fingers. No treatment after the error has been committed can succeed as will prevention. Complaint must be watched for. The needle point should not be plunged deep into the tissues of the medial aspect of the elbow. The appearance of bright red blood spurting into the syringe with each heartbeat must not be ignored.

Intravenous infusions containing levarterenol bitartrate for raising low blood pressure cause intense vasoconstriction of the punctured vein, setting the stage for an extravasation, especially if the needle has not been well placed or if the patient is restless. Needle tips for infusions, placed in veins near the wrist and elbow joints, are apt to work out. Extravasations of infusions containing levarterenol bitartrate readily cause sloughing because of the intense vasoconstriction which they produce. Other vasopressor agents may have the same effects. Infusions of oxytetracycline must also be watched closely because they irritate the vein and cause spasm, and are apt to infiltrate, producing a slough.

If an intravenous medication is needed imperatively and it is impossible successfully to puncture a vein for its administration, the sternal bone marrow route may be used. A special bone marrow puncturing needle such as the Tocantins needle is advisable. Local anesthesia is used in the skin and periosteum if the patient is awake. Force and a twisting motion are required to make the special needle penetrate the cortex of the manubrium just above its joint with the gladiolus. The point of the needle is directed cephalad at a 30 degree angle.

In children, injections and infusions may be given in the cancellous bone mar-

row of the upper tibia on the anteromedial side, with the needle directed away from the knee joint. Penetration of the bone marrow very rarely may need to be resorted to in emergencies when the peripheral veins are in spasm from shock, when treating small children, and when a convulsion is to be stopped. All substances which are suitable for intravenous administration may be given by the bone marrow route, including whole blood.

■ *Summary*

The oral surgeon is obliged to work on patients under anesthesia. Whether regional or general anesthesia is employed, the patient is subjected to the possibility of complications, some of which are of an emergency nature. The surgeon and his aides, by a carefully thought out program of safe practices, preparedness and vigilance, carry on their work in a manner to avoid emergency complications.

The relatively few emergencies which arise in spite of maximum care are treated scientifically to achieve the most successful outcome. This involves study and discussion and an understanding of the following: (1) the mechanism of the complication, (2) signs by which the complication may be recognized quickly and (3) methods of treatment, including doses of appropriate drugs. Complications arise because of disease other than that for which the patient comes seeking relief, and because of untoward effects of surgical and anesthetic treatments administered. History taking and physical examination are necessary.

The best judgment must be applied continually to the many complex problems which arise. Occasionally consultation with the internist and treatment of the patient by him are indicated. Adequate premedication and choice of a potent combination of anesthetic agents must be provided for the refractory patient, even though recovery of ability to ambulate is thereby delayed. The patient who is a bad risk belongs in the hospital, where greater facilities are at hand for medication, anesthesia, resuscitation and overnight care.

Through the years, many kinds of emergencies are seen in an oral surgery practice, from diabetic coma through coronary occlusion, convulsions, foreign body aspiration, laryngospasm, anesthetic overdose, shock, even to cardiac arrest. Maintenance of the patient's airway, the employment of oxygen-rich anesthetic mixtures with manual assistance to respiration when indicated, along with all other methods which combat anoxia, are the best assurance possible that cardiac arrest and other grave emergencies can be circumvented.—*1332 South Hope Street.*

■ LOST THOUGHTS AND THEORIES

The world little knows how many of the thoughts and theories which have passed through the mind of a scientific investigator have been crushed in silence and secrecy by his own severe criticism and adverse examinations.—*Michael Faraday, Chemical History of a Candle.*

Cutaneous fistula of dental origin

■ *Bruno W. Kwapis,* D.D.S., M.S., St. Louis, and William D. Baker, D.D.S., M.S., Phoenix, Ariz.*

Although a cutaneous fistula of the face is not a rare sequela of intraoral infection, its occurrence is infrequent enough to warrant reporting its appearance in 13 patients.

In these patients, the external cutaneous lesions arose from pulpal infections. Of the 13 patients, five, who were from a population group of low economic standards, were observed over a relatively short period of time. There were three female patients ranging from 13 to 35 years of age; the remaining patients were men, ranging from 20 to 32 years in age. Eight of the patients had first sought medical attention from a physician. A previous history of toothache was offered on specific inquiry, but this information usually was not volunteered. This is not surprising since these fistulas may develop without features suggesting a dental disturbance.

Often a case history will reveal multiple unsuccessful attempts at therapy that frequently consist of topical application of drugs. Several days prior to actual discharge of the purulent exudate, the site becomes mildly tender and has an itching sensation. The skin is slightly raised and appears inflamed and resembles the developmental stages of a furuncle. When rupture occurs, the inflammatory signs decrease, and there is a slow continuous or intermittent drainage.

Parenteral administration of antibiotics may cause cessation of drainage and apparent healing. Withdrawal of the drug usually is followed by recurrent drainage.

Roentgenograms frequently reveal tooth involvement without signs of external drainage. Apparently some factors, not immediately obvious, determine the route of establishment of external cutaneous drainage from an infected tooth. In reality, several factors occurring together or separately may be responsible for the etiology of the fistula. The first is the location of the tooth. In the series of cases described herein, only maxillary incisor and mandibular molar and incisor teeth were responsible for the condition. Wehrley,[1] however, has observed a similar process resulting from an infection arising in the right maxillary second molar. Gurdin and Pangman[2] describe two instances in which fistulas were caused by infected maxillary central incisors and one caused by a maxillary third molar. Green[3] reported on a male patient who had persistent drainage of six years' duration from a site along the side of his nose that had originally been diagnosed and treated as a dacrocystitis. Dental examination disclosed

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1. Wehrley, D. F. Personal communication.
2. Gurdin, M., and Pangman, W. J. Dermal sinuses of dental origin with report of three cases. Plast. & Reconstr. Surg. 11:444 June 1953.
3. Green, J. R. Inflammatory swellings simulating dacrocystitis. Tr. Am. Ophth. Soc. 22:244, 1924.

a cuspid with pulpal infection to be responsible. A similar instance has been observed by Bauer.[4]

Brophy[5] described an instance of drainage arising from an abscessed mandibular third molar that made a path through the fascia of the neck to emerge in the sternoclavicular region. These case reports substantiate the implication of certain dental disorders in the occurrence of cutaneous fistulas.

A second factor is root length; the greater the root length is, the more probable it is a cutaneous fistula will develop. These two factors are directly associated with a third—the critical level of the line of attachment of the buccinator muscle for fistulization from mandibular and maxillary molar teeth, the mentalis muscle from lower incisors, and the canine muscle from maxillary cuspids as described by Sicher.[6]

Gangrenous pulpitis is seldom confined to the tooth and soon involves the supporting periapical region and produces a root-end abscess. The extension of this periapical process eventually perforates the cortical plate of the jaw. The emerging pus elevates the periosteum and extends along beneath it until a line of muscle attachment is reached. Since the latter is resistant to detachment, the purulent fluid seeks an exit at this point through the soft tissues, and thus a fistula is produced.[7]

If pus from a mandibular molar tooth emerges above the mandibular attachment of the buccinator muscle, it will seek an exit into the oral cavity through a gingival fistula. If the roots of the responsible tooth are long and the muscle attachment high, however, the pus will make its way through the soft tissues of the cheek and exit through a cutaneous rupture (Cases 1, 2, 3).

In the maxilla, a similar phenomenon can occur. Purulent exudate from a maxillary molar erodes through the bone above the buccinator muscle attachment to exit through the cheek, whereas exudates below the muscle attachment will emerge by way of a gingival fistula.

When the mandibular incisors are involved, the position of the mentalis muscle attachment is the controlling factor. The chin or submental region are the points of exit from these teeth (Cases 4, 5). When maxillary incisor teeth are involved, particularly the cuspids, it is the attachment of the canine muscle that determines the route of exit (Case 6).

A differential diagnosis of a cutaneous fistula is difficult without intraoral roentgenograms. According to Sutton and Sutton,[8] the most common error in diagnosis is to mistake them for granuloma pyogenicum, since granulation tissue surrounds the subcutaneous area of the fistulous tract. The resistance to treatment, other than by surgical intervention, of a granuloma pyogenicum and of a dental fistula is similar. Jillson and Preston[9] reported an instance in which a cutaneous fistula on the chin, in desperation, had been irradiated with roentgen rays and even cauterized without healing, until the diseased teeth that were responsible had

4. Bauer, W. H. Personal communication.
5. Brophy, T. W. Oral surgery. Philadelphia, P. Blakiston's Son & Co., 1915, p. 764-767.
6. Sicher, Harry. Oral anatomy, ed. 2. St. Louis, C. V. Mosby Co., 1952, p. 450-452.
7. Noyes, F. B., and others. Oral histology and embryology, ed. 6. Philadelphia, Lea & Febiger, 1948, p. 239-240.
8. Sutton, R. L., and Sutton, R. L., Jr. Diseases of the skin, ed. 10. St. Louis, C. V. Mosby Co., 1939, p. 1490.
9. Jillson, O. F., and Preston, R. H. Sinus tract of dental origin. A.M.A. Arch. Dermat. & Syph. 64:637 Nov. 1951.

been removed. The possibility of a dental cause in the etiology of a cutaneous fistula must be eliminated.

The cutaneous opening of a salivary gland fistula may resemble one of dental origin. In contrast to the latter, however, the exudate from a salivary gland fistula is usually clear and if purulent, an associated history of glandular infection will be present. As a rule, salivary gland fistulas do not arise spontaneously without previous symptoms, but rather follow trauma or surgical intervention to the salivary structure.

Fistulas in actinomycosis are usually multiple, and the cutaneous tissues exhibit typical, profound inflammatory changes. Although old, unhealed infected fractures of the jaw will drain similarly to fistulas of dental origin, differential diagnosis can be made from a history of trauma.

Once the diagnosis of cutaneous fistula of dental origin is made, the treatment is not difficult. Elimination of infection causes a cessation of drainage. The responsible tooth should be extracted, or where practical, root canal therapy with apicoectomy performed. The periapical lesion and the fistulous tract should be well curetted.

In the series of 13 patients discussed herein, penicillin was administered to assist in controlling the infectious process. All the lesions healed spontaneously after the treatment already described. After the alleviation of the infection, the sinus tract healed by scar formation, taking the form of a tight unyielding, "cordlike" structure which extended from the skin to the bone. Its effect in skin depression was most noticeable during active facial movement such as mastication or speaking.

For esthetic purposes, excision of the healed tract was found to be necessary for two of the patients because the fistulas had drained for a prolonged period of time. This was accomplished by excising the healed skin lesion and dissecting out the cordlike mass of scar tissue as described by Thoma.[10] The cosmetic result following this procedure was most satisfactory.

Adverse sequelae to cutaneous fistulas of infectious origin are possible. Since the fistulous tract in a chronic process may become epithelized, squamous cell carcinoma can develop. Such an instance has been reported by Wende and Soloman.[11] This neoplasm developed in the sinus tract of the cutaneous drainage from a retained mandibular molar root. The lesion was excised and microscopic examination disclosed a "squamous cell carcinoma of differentiated cell type with pearl formation." If the cutaneous fistula does not heal after the elimination of the dental infection, a biopsy is indicated.

■ *Report of Cases*

The following are selected examples from the series of 13 patients with cutaneous fistula of dental origin.

CASE 1—A 23 year old negro man had a draining right cheek fistula of one month's duration. Roentgenograms disclosed the source of infection to be the right mandibular second molar. In this instance the distal root of the molar had been resorbed by an impacted bicuspid.

10. Thoma, K. H. Oral surgery, ed. 2. Vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1011-1015.

11. Wende, R. C., and Soloman, H. A. Cutaneous fistulas of dental origin. Arch. Dermat. & Syph. 46:665 Nov. 1942.

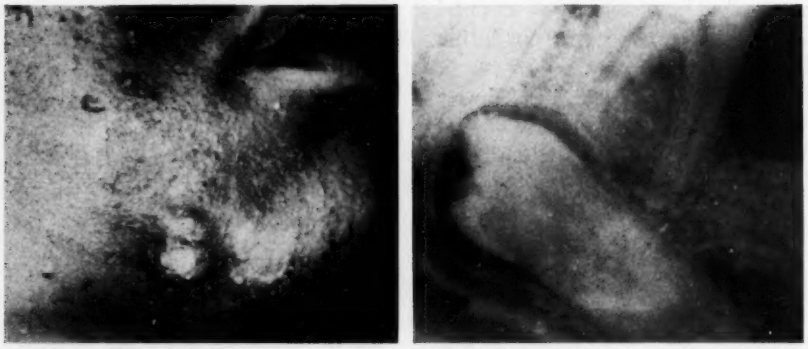

Fig. 1—Case 1. Left: Cutaneous fistula of right cheek of one month's duration. Right: Showing resorption of distal root of mandibular second molar by impacted bicuspid

Healing of the external lesion followed the removal of the two teeth (Fig. 1).

CASE 2—A 27 year old man had a cutaneous fistula of the right cheek of two months' duration. The roentgenograms disclosed a chronic infected lesion distal to an unerupted right mandibular third molar. The skin lesion healed promptly after removal of the offending tooth (Fig. 2).

CASE 3—A 20 year old patient had a draining cutaneous fistula of the right cheek of eight months' duration. Roentgenographic examination of this patient revealed a chronic periapical infection of the right mandibular second molar. Healing promptly followed removal of the tooth (Fig. 3).

CASE 4—A 13 year old girl had a cutaneous fistula on the chin. The left mandibular lateral incisor had been injured several years earlier. Roentgenographic examination of the teeth revealed a periapical abscess of the tooth. When a root

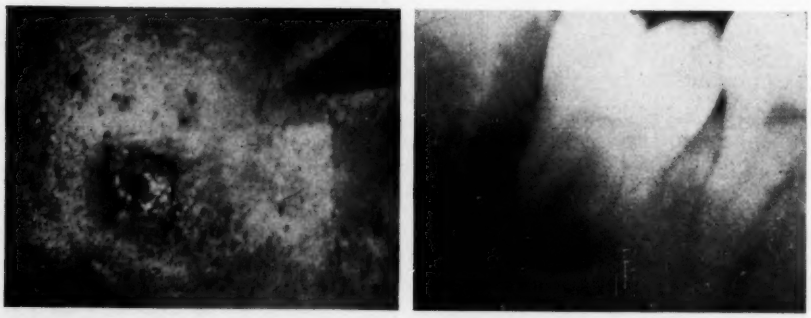

Fig. 2—Case 2. Left: Cutaneous fistula of right cheek of two months' duration. Right: Source of infection is from mandibular third molar

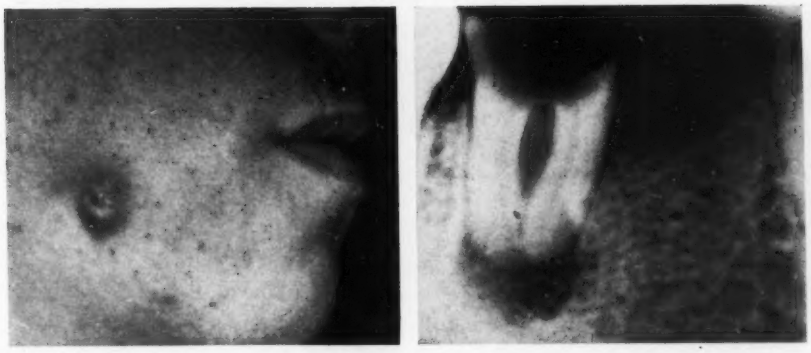

Fig. 3—Case 3. Left: Cutaneous fistula of right cheek of eight months' duration. Right: Source of infection is periapical lesion of right mandibular second molar

Fig. 4—Case 4. Left: Cutaneous fistula of dental etiology which occurred on chin. Right: Source of infection is periapical lesion of mandibular incisor

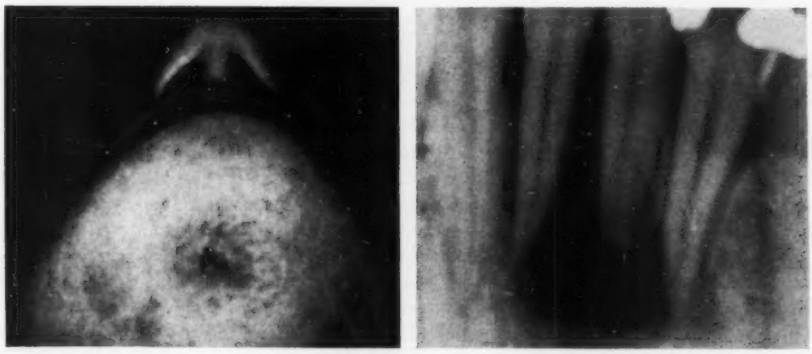

Fig. 5—Case 5. Left: Cutaneous fistula of two months' duration which occurred in submental region. Right: Source of infection is large periapical abscess of mandibular incisors

Fig. 6—Case 6. Cutaneous fistula along side of nose

canal filling was inserted and an apicoectomy performed, uneventful healing of the cutaneous lesion occurred (Fig. 4).

CASE 5—The drainage in a 25 year old man was from the submental region and was of two months' duration. Roentgenograms disclosed a large periapical abscess of several mandibular incisor teeth. Healing of the external lesion followed the extraction of these involved teeth (Fig. 5).

CASE 6—A 32 year old white man had persistent drainage from the side of the nose arising from an infected maxillary cuspid. The condition was treated successfully by root canal therapy and an apicoectomy (Fig. 6).

■ *Summary*

A cutaneous fistula may develop from an infected tooth. These cutaneous lesions usually arise without dental symptoms and for this reason are often incorrectly diagnosed. Intraoral roentgenograms are essential in making a correct diagnosis.

Diseased maxillary and mandibular molars and incisors have been observed to be responsible for this condition. The root length of these teeth and the position of the attachments of the buccinator, mentalis, and canine muscles are contributing factors to the development of these external fistulas.

Elimination of the infectious process in the teeth and curettage of the periapical lesion and sinus tract are prescribed. If the cutaneous lesion fails to heal after this treatment, a biopsy is indicated.

■ ANIMAL AND HUMAN REASONING

In forming a judgment of animal reasoning it is well to remember that we, humans, have but one psychology. The general idea seems to be that we should seek a special psychology, distinct from our own, in order to understand the animals. Nothing could be more erroneous or misleading. So far as we can see, the laws of mind are as constant as the laws of physics and chemistry, which apply equally well to oil wells and the light from Arcturus and the Pleiades. We know a little, a very little, of our own psychology, and that is the only measure we possess to lay upon the life of any creature. All thought except my own is strange to me; I am never sure of it but can only infer and then estimate it from the actions of the animal under observation. Whether the animal be a man or a bear or a parrot, I am under the same necessity to watch his actions and then infer his mental process from what goes on in my own head under similar circumstances. In a word, I must judge animals by myself, since I know no other standard. To one who judges animals in this rational way there is no doubt of their occasional reasoning. The only problem lies in the quality and amount of that reason and in the origin and cause of this whole process of history which stretches between us and the animal kingdom.—*William J. Long. "The Spirit of the Wild," Doubleday & Co., 1956.*

Management of tumors of the inferior alveolar process and mandible with special emphasis on immediate bone grafting

■ *John J. Conley, M.D., New York*

The vast majority of tumors of the inferior alveolar process and mandible are first seen by the dentist. The alertness of his response to the existence of these various conditions parallels the success of their outcome.

Procrastination in making the microscopic diagnosis is unwarranted when the possibility of a malignant tumor exists, for some type of surgical management is almost universally necessary for the cure of both benign and malignant tumors arising in this location. In localized benign lesions the excisional part of the treatment may be minimum with no resultant disfiguration or impairment of function. On the other hand, adequate excision of extensive tumors may result in a crippling deformity of the lower third of the face with loss of continuity of the mandibular arch and subsequent interference in eating, speaking and esthetics. Although ingenious intraoral appliances have been developed as substitutes for a deficient mandible, they are never completely satisfactory from a functional point of view. It is the purpose of this paper, therefore, not only to illustrate the various types of treatment of tumors of the inferior alveolar process and mandible, but also to emphasize immediate reconstruction of the mandibular arch by free bone grafting.

■ *Incidence*

Although benign tumors of the inferior alveolar process and mandible are common, malignant tumors in this location are relatively uncommon. They occur three times more often in men than in women and are seen most frequently in the sixth and seventh decades of life. The vast majority are epidermoid carcinomas and are responsible for 0.5 per cent of all the deaths from cancer in the United States.

■ *Clinical Behavior*

Benign tumors originating in the mandible and inferior alveolar process have no characteristic early clinical symptomatology. They may remain stationary in size and be discovered quite accidentally on routine examination, or they may grow to huge proportions, destroying the local tissue as they expand. An active, expanding, benign tumor eventually produces a sensation of pressure and tooth sensitivity or localized pain in the jaw. Usually by the time this is recognized by the patient, the mass is discernible on clinical examination (Fig. 1).

Cancer of these sites in the early

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stages may be discovered accidentally by the patient or his dentist as a painless, reddish, granular ulceration, frequently developing in a fissure or in an area of leukoplakia. As the lesion increases in size, a local cellulitis and adenitis develops, the underlying bone becomes involved (Fig. 2), and the patient is aware of discomfort and pain. In this advanced stage of development (Fig. 3), frequently there is evidence of metastasis to the glands of the neck.

Sarcomas developing within the mandible (Fig. 4) may cause loosening of the teeth and produce a dull aching sensation in the jaw. They readily invade the lymphatic and vascular channels with evidence of spread not only to the regional lymph nodes but also to the liver and brain. Prognosis is poor.

Plasmacytoma (and myeloma) of the mandible is rare. It may manifest itself as a single or multiple granulomatous cyst with local destruction of the medullary part of the mandibular structure with no other evidence of systemic involvement. It may also behave like a carcinoma in that there may be evidence of metastasis of the plasmacytoma in the regional lymphatic drainage bed, with no other evidence of systemic disease. This disease may remain localized or may manifest a diffuse, systemic involvement characteristic of widespread plasmacytoma or multiple myeloma. Prognosis under these latter circumstances is extremely grave.

■ *Diagnosis*

Diagnosis is made by clinical investigation, by stereoscopic roentgen ray study of the mandible and by biopsy. Roentgenographic examination of lesions occurring in the medullary cavity of the bone is an important diagnostic aid, whereas clinical examination of external lesions occurring on the alveolar process and mandible usually gives the examiner an accurate impression of the disease. For final analysis, an adequate biopsy is essential in every instance. This is particularly

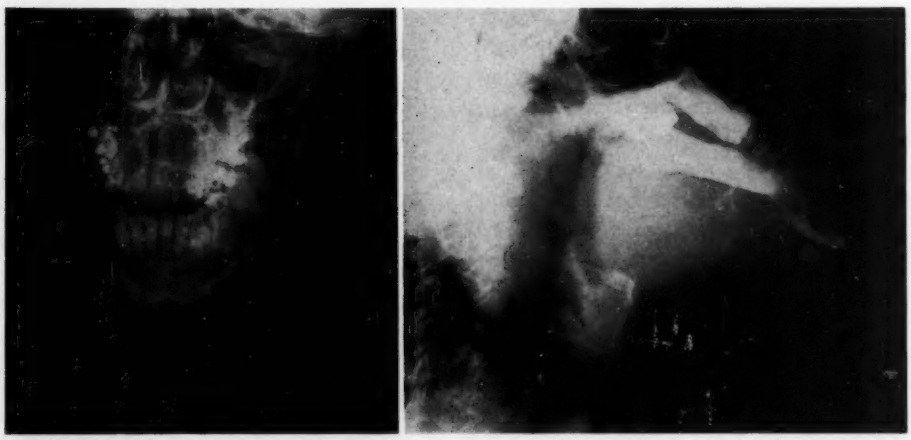

Fig. 1—Left: Myxoma of right horizontal ramus. Right: Extensive adamantinoma of entire mandible

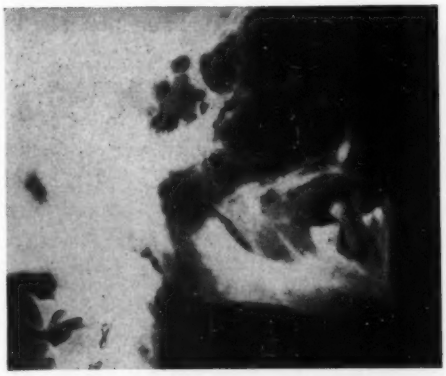

Fig. 2—Epidermoid cancer of alveolar process invading horizontal ramus of mandible

true when the diagnosis of malignancy is suspected and procrastination may forfeit the patient's life. A procurement of tissue by punch forceps or aspiration may be done as an office procedure with little inconvenience. The value of arriving at an accurate diagnosis cannot be overemphasized.

■ *Surgical Treatment*

The treatment of choice of all benign and malignant tumors of the inferior alveolar process and mandible is surgical removal. The surgical technics are devised to accommodate themselves to the caliber, size, position and type of the tumors. Limited benign tumors in this area usually are cured by a single conservative excision which does not cause any deformity or interference with function. Small cysts are externalized and relieved of their contents and lining membrane. Small, benign, bony tumors are conservatively excised without interference with function. Small (less than 2 cm.) low grade cancers of the alveolar process are removed intraorally by segmental (or marginal) resection of the alveolar process or mandible when there is no evidence of metastasis to the neck.

In extensive benign tumors and very large cysts of the mandible where the entire body of the mandible is involved, and in cancer of the mandible with or without metastasis to the neck, it is necessary to perform at least a sectional resection of the mandible with destruction of the continuity of the arch (Fig. 1, right, 2 and 3). Resection of the full thickness of the mandible is a problem of particular significance because of the interference with the function of mastication if the continuity is not restored. The fundamental surgical approach to this problem is the replacement of the lost bone in the mandible by a free autogenous bone graft held in position by internal fixation. Other substitutes, such as homologous bone, Vitallium, tantalum and acrylic prostheses, may be useful as a temporary surgical expediency, but have not been as satisfactory as the use of autogenous bone.

In infected wounds or heavily irradiated wounds where free bone grafting

Fig. 3—Advanced cancer of alveolar process and mandible and neck

is unwarranted, the use of an inert compound (either plastic or metallic) is a helpful procedure to maintain the form of the lower third of the face and the continuity of the mandibular arch with the hope of doing permanent bone grafting at a later date.

Internal fixation, with specially adapted Vitallium plates and screws (Fig. 5) or Steinmann pin (Fig. 6, left) with the assistance of intermaxillary wiring, has advantages over external fixation by the Roger Anderson apparatus or intermaxillary wiring alone. The chief advantage consists of more rapid rehabilitation, permitting the patient to use the mandible in a limited way, after a period of one or two weeks, for the purposes of speech and partaking of a liquid and soft diet by mouth. This technic does not prevent attaining perfect occlusion by temporary intermaxillary wiring when teeth are present.

A series of 30 consecutive patients in whom this technic has been carried out confirms the usefulness of this procedure.

■ *Technic*

Any benign tumor or cyst which has involved the entire thickness of either the mentum, horizontal ramus or ascending ramus whose total removal either threatens or causes a disintegration of the mandibular arch should be treated by a sectional resection of that portion of the mandible and immediate bone grafting. Under these circumstances it is rarely necessary to sacrifice any associated soft tissues of the mouth or neck. The surgical approach depends on the size, character and position of the tumor in the mandible. Small tumors of the horizontal ramus or mentum may be excised intraorally. If the tumor requires additional exposure, a submaxillary skin incision or a lip splitting incision may be made. If the patient has teeth, wires are placed about them on the day prior to the operation. After the patient has been anesthetized by the naso-endotracheal route or by preliminary tracheostomy, the teeth are fixed in occlusion after the benign tumor has been excised.

A portion of bone is removed from the anterior iliac crest for major reconstruction or occasionally from the rib for reconstruction about the mentum. This graft is modeled to be the exact size and shape of the deficient segment of mandible. With the teeth in occlusion, the bone graft is fixed into position by a special Vitallium plate and screws (Fig. 6 and 7). In order to obtain absolute fixation it is necessary to embed two screws in the anterior mandibular segment, two screws in the posterior mandibular segment and two screws in the bone graft. If it has been necessary to create an intraoral wound, it is closed with great care with individual fine silk sutures which can be removed intraorally within a period of five to ten days postoperatively. This wound must be closed in such a fashion that saliva will not drain on the bone graft postoperatively. The skin wound is then closed in layers, and a drain is placed at the inferior pole. A supportive dressing is applied. The drain is gradually withdrawn over a period of the next five to seven days.

The teeth which have been in occlusion during this actual bone grafting procedure are released at the termination of the operation. If this important step is not carried out, the patient may die of strangu-

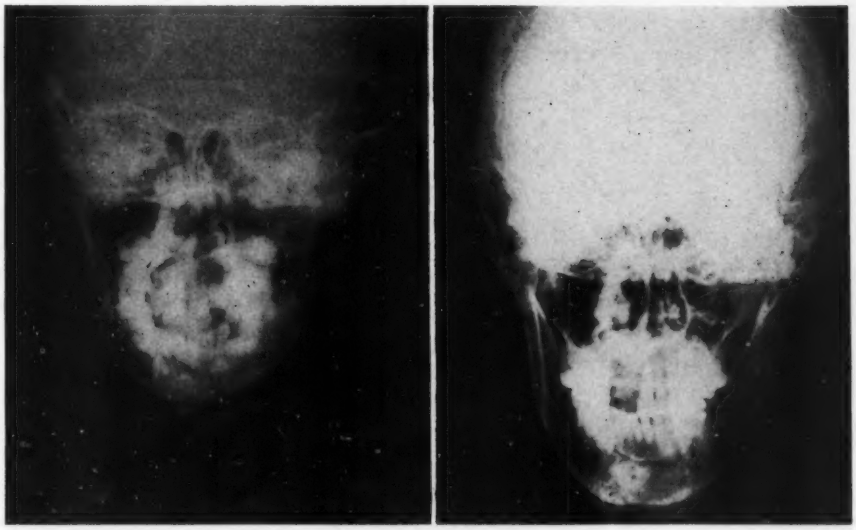

Fig. 4—Left: Neurogenic sarcoma of left ascending ramus of mandible. Right: Osteogenic sarcoma of left horizontal ramus of mandible

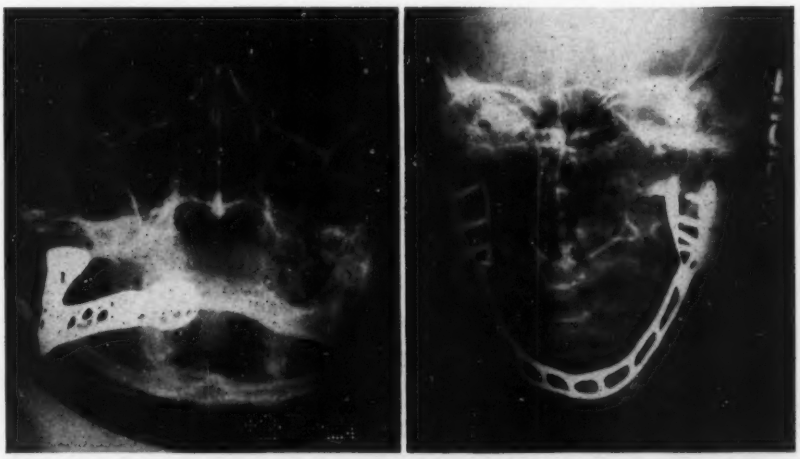

Fig. 5—Left: Reconstruction of half of mandible by Vitallium prosthesis. Right: Reconstruction of horizontal rami with Vitallium prosthesis

lation after the removal of the naso-endotracheal tube. Occlusion may be restored on the following day or the wires may be removed at the discretion of the operator. Large doses of biotherapy are administered for a period of two weeks. The patient is fed by a nasogastric feeding tube. If the wound heals by first intention, as occurs in 90 per cent of the cases, the feeding tube may be removed on the tenth or twelfth postoperative day, and the patient may be given a liquid diet by mouth. After six to eight weeks the patient can resume a normal diet. Postoperative functional and cosmetic results are gratifying (Fig. 8).

If the above bone grafting technic is carried out in a person who is edentulous, the intermaxillary wiring technic does not pertain. Under these circumstances, special care is taken to replace the resected mandibular segment with a graft exactly the right size and shape, so that when it is plated into position, occlusion will be relatively normal.

Occasionally, benign tumors and cysts of the mandible become so massive in size that a modification of this technic may be necessary. This has been found necessary in instances where adamantinomata have involved the horizontal and ascending ramus of the mandible and a modification has been necessary in order to save the functioning head of the condyloid process in the glenoid fossa (Fig. 1, right).

The successful treatment of cancers of the inferior alveolar process and mandible confronts the surgeon not only with the control of the local disease, but frequently with the metastatic deposits in the neck. Approximately 50 per cent of the advanced cases of cancer of the inferior alveolar process and mandible have metastasized within the neck when first seen. There is often direct extension into the

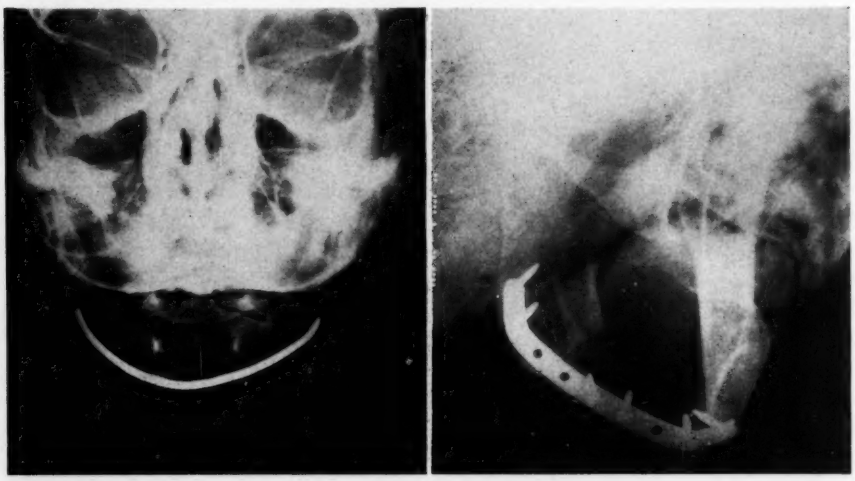

Fig. 6—Left: Steinmann pin in alveolar canals to stabilize mandible. Right: Reconstruction of horizontal ramus by autogenous iliac bone graft fixed with Vitallium plate and screws

glosso-alveolar and bucco-alveolar sulci, cheek, floor of the mouth and tongue.

The control of this advanced stage of cancer requires the excision of not only these involved structures in the intraoral cavity but also the lymphatic drainage bed in the neck. No compromise is made in the surgical efforts to eradicate the cancer, yet, in the past, little attention was paid to the idea of immediate total reconstruction of these wounds. Perhaps before the days of biotherapy when many wounds were complicated by infection, this attitude was warranted. With the high incidence of successful bone grafting today under selected circumstances, however, there is no justification for neglecting the procedure.

In the past, the ascending ramus of the mandible and head of the condyloid process were frequently sacrificed with the specimen, even though cancer rarely arises in or extends into the ascending ramus. The unnecessary loss of this important structure unnecessarily precluded even competent delayed reconstruction and is to be condemned.

■ *Criteria for Operation*

For Class I cancer, that is cancer of the inferior alveolar process or mandible or both (limited to 1 to 2 cm. and no evidence of metastatic disease), the indicated operation is sectional resection of the inferior alveolar process and mandible and suprahyoid dissection in continuity with immediate bone grafting.

For Class II cancer, cancer of the inferior alveolar process and mandible with metastatic cancer in the same side of the neck, the indicated operation is sectional resection of the alveolar process and mandible and lateral neck dissection in continuity with immediate bone grafting.

Fig. 7—Autogenous bone graft and stainless steel plate to restore mandible after complete resection

For Class III cancer, that is, extensive cancer of the inferior alveolar process and mandible with involvement of the floor of the mouth, tongue and unilateral or bilateral neck areas, the indicated operation is resection of half or more of the alveolar process and mandible with a segment of tongue and floor of the mouth and lateral neck dissection in continuity. Immediate bone grafting is not indicated. If the other side of the neck is also involved, a bilateral simultaneous neck dissection saving one internal jugular vein may be performed, or the operation can be done in two stages two weeks apart and all veins can be removed. Although a complete, bilateral, radical neck dissection plus excision of the primary lesion can be carried out readily, the extended morbidity and increased operative risk raises the question whether it is warranted.

■ *Prognosis*

The prognosis for cure of benign tumors of the inferior alveolar process and mandible by surgical excision is excellent. There is a 90 per cent chance of a successful "take" of a free bone graft when this is used to restore the continuity of the mandibular arch. Approximately 70 per cent of the early limited cancers in this region are cured when treated as discussed previously. Advanced carcinoma of the inferior alveolar process and mandible with metastasis to the neck has a rate of cure of approximately 30 per cent. Extensive excision of the alveolar process, floor of the mouth, tongue, mandible and neck creates a wound of such magnitude intraorally that bone grafting is out of the question. Satisfaction is obtained if control of the cancer is helped and if the wound heals by first intention without a bone graft. This type of case is assisted by an intraoral prosthesis, which improves both facial contour and the functional capacity of the remaining segment of the mandible.

■ *Summary and Conclusions*

Immediate bone grafting should be considered in all resections of the mandible where a section of alveolar process and mandible, and suprahyoid or lateral neck contents are removed in continuity. The limiting factors are the quality of tissue bed and the size of the dead space created. Immediate bone grafting is not justified in intensely irradiated tissue beds. Neither is it warranted when there has been an extensive excision including half of the tongue, floor of the mouth, buccal and alveolar sulci and a portion of the cheek along with the lateral neck contents. In this latter instance, the extensive amount of tissue lost precludes the im-

Fig. 8—Postoperative resection of mandible and neck for cancer of alveolar process, mandible and lateral neck. Iliac bone graft was immediately implanted

plantation of a bone graft. Further care should be given to the preservation of the ascending ramus of the mandible which is rarely involved in the cancerous process, so that it may be used either immediately or at a later date in the bone grafting technic. The routine excision of this uninvolved portion of the mandible is to be condemned.

The incidence of successful "take" of the free bone graft in Class I cancer is 90 per cent and in selected cases of excision of the mandible, floor of the mouth and neck (Class II) is about 70 per cent.

The internal fixation of the bone graft with a special Vitallium plate and screws with or without the assistance of maxillary wiring has the advantages of immediate, absolute fixation in the mandibular arch, shortened hospital stay and morbidity period, a limited return of function of the mandible within two weeks and a minimal amount of inconvenience to the patient.

A series of 30 consecutive cases on which this technic has been carried out confirms the value of the procedure.—*139 East 36th Street.*

■ BENJAMIN FRANKLIN AND SCIENCE

. . . The rapid progress true science now makes, occasions my regretting sometimes that I was born so soon. It is impossible to imagine the height to which may be carried, in a thousand years, the power of man over matter. We may perhaps learn to deprive large masses of their gravity, and give them absolute levity, for the sake of easy transport. Agriculture may diminish its labour and double its produce; all diseases may by sure means be prevented or cured, not excepting even that of old age, and our lives lengthened at pleasure even beyond the antediluvian standard. O that moral science were in a fair way of improvement, that men would cease to be wolves to one another, and that human beings would at length learn what they now improperly call humanity.—*Letter from Benjamin Franklin to Joseph Priestley written February 8, 1780.*

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CASE REPORTS

Junctional nevus of the palate: *report of case*

■ *C. Dean Couch, Jr.,* D.D.S., Eglin Air Force Base, Fla., and Myron Kaufman,† D.D.S., Detroit*

The infrequent occurrence of a nevus within the oral cavity is evident from the paucity of case reports. Nevi occur most universally on the skin and form one of the most interesting topics in oncology.

Most junctional nevi are pea-shaped, relatively smooth, flat or slightly raised and hairless. They range in color from light brown to black, and are seldom verrucose or pedunculated. They occur most frequently on the head, hands, feet, and genitals.

The etiology of nevi[1] has been a controversial subject since 1900. It was first suggested that they were of epithelial origin. As spindle cells were noted in some of them, however, which suggested a relation to connective tissue, they were placed in the classification of sarcomas. The latest theory is that they may be of neuroblastic origin.

Traub and Keil[2] have divided nevi histologically into the following groups: intraepidermal, intradermal, junctional (those at the dermoepidermal border), combination type, and blue nevi. They believe that the junctional type is the most dangerous, since it is more prone to become malignant.

Histologically,[3] junctional nevi are characterized by collections of clear, rounded or polyhedral nevus cells situated partly in the epidermis and partly in the dermis. These nevus cells are closely packed and present a characteristic appearance. There are only a few deeply pigmented cells and these tend to lie at the periphery of the cell cluster. The amount of pigment varies greatly and bears no relation to possible malignancy.

REPORT OF CASE—A white 50 year old woman entered the hospital on May 10, 1954, with a chief complaint of a growth in the roof of her mouth. She had first become aware of this lesion approximately four years before the examination. Except for a gradual increase in size, particularly during the previous year, the lesion had been asymptomatic.

Physical examination revealed a well developed, well nourished adult in no acute distress. Intraoral examination revealed a black pigmented area in the midline of the posterior portion of the hard palate (Fig. 1, left). The lesion was not elevated, not tender, was well defined and approximately 1 cm. in diameter. There was evidence of recent surgery to the lesion, a biopsy having been done three weeks prior to this admission. Further physical examination failed to reveal any other significant

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2. Traub, E. F., and Keil, H. Common mole, its clinicopathological relations and question of malignant degeneration. Arch. Dermat. & Syph. 41:214 Feb. 1940.
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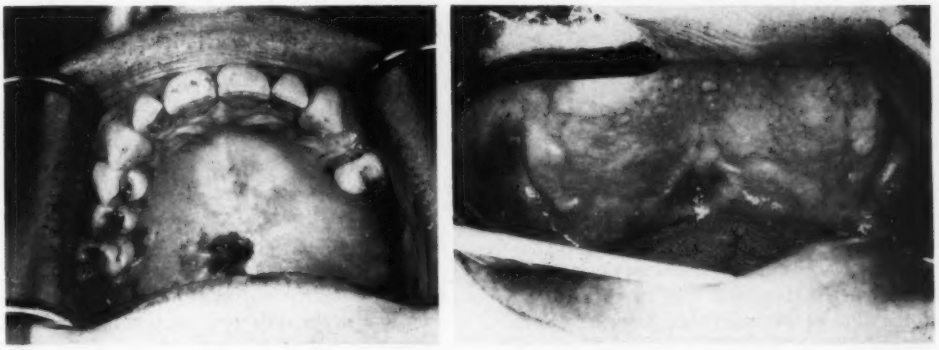

Fig. 1—Left: Junctional nevus of palate, four days after biopsy, (biopsy site at right lateral margin of lesion). Note well defined margin of lesion. Right: Healing operative defect one month after excision of lesion

observations. Laboratory findings were within normal limits.

On the following day the neoplasm was excised under endotracheal anesthesia. An incision was made around the lesion, care being taken to stay well into what clinically appeared to be normal tissue. This incision extended down to the palatal bone. The lesion was dissected free from the underlying bone with a periosteotome. There was a copious amount of bleeding which was controlled with pressure and topical epinephrine. After hemostasis was obtained, the area of excision was dressed with an anodyne surgical cement dressing which was maintained in position with two black silk mattress sutures. The patient left the operating

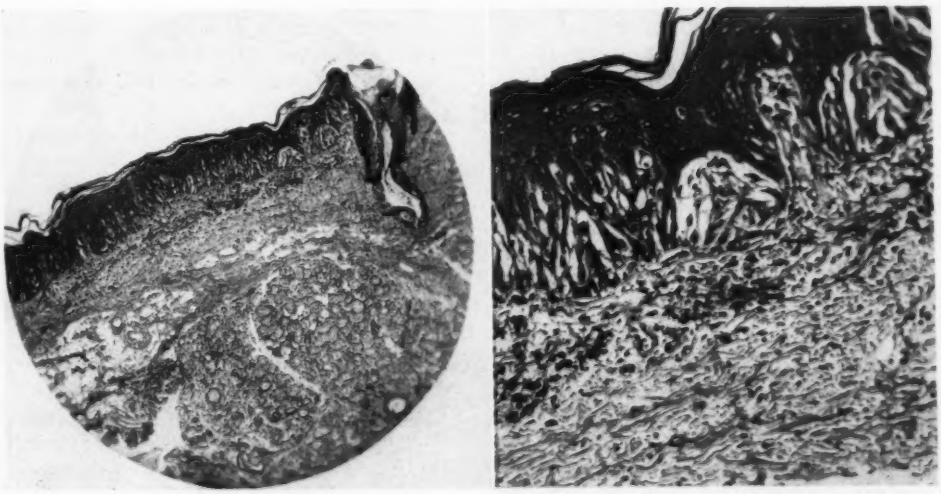

Fig. 2—Left: Photomicrograph of lesion. Note junctional invasion by pigmented nevus cells. Right: High-power photomicrograph of lesion. Nevus cells confined to squamous layer and subepithelial layer

room in good condition. The postoperative course was uneventful, and healing occurred by secondary intention (Fig. 1, right).

PATHOLOGICAL EXAMINATION — Gross pathological examination revealed a specimen consisting of a segment of tissue measuring 1.5 by 1.5 by 0.4 cm. in size. One surface was represented by pale white mucosa which showed a slight degree of thickening with an irregular blackish discoloration measuring 1 cm. at its greatest diameter. The opposing surface to the mucosa was pale white in color. On the cut surface, the blackish discoloration appeared to be confined to the mucosa. Deep to the mucosa, the cut surface of the tissue was grey-yellow in color.

Microscopic examination showed the surface of the tumor mass to be covered by keratinizing squamous epithelium of quiescent type which showed some evidence of acanthosis, evidenced by widening and elongation of the rete pegs. There was no increase in mitotic figures, and the cells in the squamous epithelial layer showed no evidence of pleomorphism. In one area there was definite junctional invasion by nevus cells, many of which contained a yellow-brown pigment (Fig. 2, left). These individual cells had ovoid nuclei, without evidence of hyperchromatism. No mitoses were identified. The majority of the cells appeared to be within the squamous layer; however, nevus cells were also present in layers adjacent to the epithelium (Fig. 2, right). The submucosal connective tissue showed focal regions of infiltration by small, round lymphocytes. Throughout the sections there were also numerous mucus-producing glands. The deeper tissues were composed primarily of dense fibrous connective tissue, with collagen production. No nevus cells were present in this area. From the microscopic appearance of the sections, it was apparent that the entire lesion had been removed surgically.

The final diagnosis was pigmented junctional nevus; no evidence of malignant transformation.

COMMENT—Any circumscribed pigmented growth situated in the mouth which is clinically suspected or recognized as being a nevus, particularly if it is situated in a region which is subjected to daily trauma, should be surgically excised. It is well to consider all solitary pigmented nevi as premalignant and treat them as such.

Root resorption of second molars caused by third molar impactions: *report of case*

■ *James Springer, D.M.D., Detroit*

Completely unerupted third molars frequently are found impacted in the maxilla and mandible. Until discovered by roentgenographic examination of the dentition, their presence is often unsuspected by the patient.

One comparatively rare complication caused by such impactions is root resorption of the second molar adjacent to the third molar. Root resorption may be caused by pressure expansion of a cyst originating from the dental follicle of the unerupted third molar crown, or it may be due to pressure exerted by the

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Fig. 1—Mesial, central and distal views of the lower second molar (left, center and right) show resorption of its distal root

impacted third molar growing directly against the root of the second molar. The end result usually is the extraction of both the impacted third molar and the second molar anterior to it.

The following case illustrates root resorption of upper and lower second molars that was caused by direct growth pressure from two completely unerupted impacted third molars.

REPORT OF CASE—The patient, a 33 year old white man, was referred to the dental clinic from the ear, nose and throat section of the U. S. Army Dispensary, with an undiagnosed complaint of submandibular lymphadenitis of 48 hours' duration. There was no past or current history of toothache. An enlarged tender lymph node approximately 3 cm. by 2 cm. in size was palpable below the left angle of the mandible. The patient's temperature was 98.4°F.

A full complement of teeth, excepting third molars, was present. No teeth were sensitive to percussion, and the periodontal tissues were healthy. Exploration of the gingival crevices distal to the second molars showed no evidence of pathology. The teeth were in good occlusion excepting for the maxillary incisors which were in a slightly retrusive position.

ROENTGENOGRAPHIC EXAMINATION—Lateral jaw roentgenograms revealed a completely unerupted mesioangular impacted lower left third molar. The distal root of the adjacent second molar was partially resorbed. An unerupted third molar was also noted in the left maxilla.

Intraoral views taken at mesial, central and distal angulations confirmed the root resorption of the lower left second molar (Fig. 1). An occlusal view demonstrated the lower impacted third molar to be lying close to the lingual aspect of the mandible. Intraoral views taken at regular and at high angulations revealed mesioangular impaction of the completely unerupted upper left third molar with accompanying resorption of the distobuccal root of the adjacent second molar (Fig. 2).

DIAGNOSIS—The unerupted mandibular third molar was believed to be the etiologic factor in the lymphadenitis, but it was felt that in all probability the adjacent second molar, sound except for the root resorption, was not contributing to the infection.

It was reasonable to assume that quiescent pathogenic bacteria inhabiting the coronal remnants of the dental follicle of this deep-seated impaction had become active. Inflammatory exudate from the pericoronitis apparently could not drain into the oral cavity. Drainage was therefore channeled directly into the regional submandibular lymph node and produced the lymphadenitis.

TREATMENT—Heat and antibiotic therapy was administered. The patient was placed on a regime of continuous hot saline mouth irrigations and external applications of wet heat. Over a five day period he received a total of three million units of penicillin G procaine in aqueous solution in five intramuscular injections.

After three days of treatment, the enlarged tender lymph node improved. At this time both

Fig. 2—Regular and high angulation views of the upper third molar region (left and right) show resorption of distobuccal root of second molar

the lower left impacted third molar and the resorbed second molar were removed under local anesthesia. Healing was uneventful.

Two months later the upper left impacted third molar and the resorbed second molar were removed under local anesthesia with prophylactic antibiotic therapy. The patient was observed periodically. At the time of his last visit 14 months postoperatively, there had been no recurrence of lymphadenopathy.

PATHOLOGY REPORT—The lower left second molar was sent to the Armed Forces Institute of Pathology with a request for examination of the specimen. Joseph L. Bernier, of the Dental Corps, submitted the following report: "A lower molar tooth was examined. The distal root shows evidence of an old resorptive process and at the moment is inactive. The coronal portion of the pulp shows a heavy deposition of secondary dentin with a well delineated border of odontoblasts. There is some congestion of the blood vessels and evidence of reticular atrophy. Diagnosis: External resorption" (Fig. 3).

DISCUSSION—A case has been presented wherein two sound second molars had to be extracted because of complications resulting from two completely unerupted third molar impactions in the same individual. The failure to discover and extract these impactions earlier resulted in the resorption of the roots of the adjacent second molars by direct growth pressure of the impacted teeth.

Routine dental roentgenograms of an adolescent patient will reveal the presence of

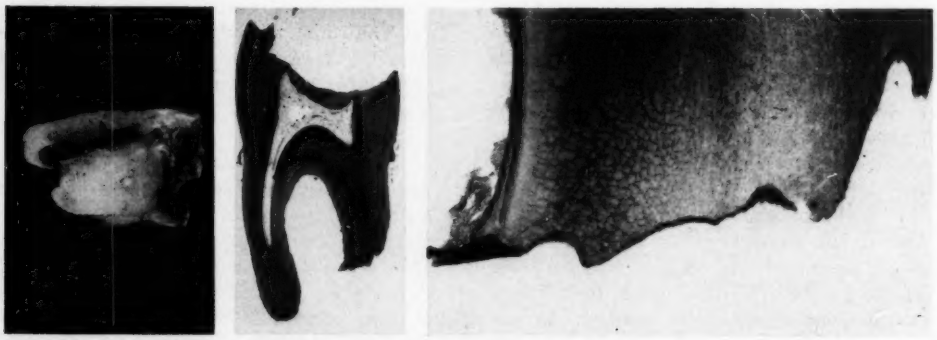

Fig. 3—External resorption of lower second molar. Left: Gross specimen before preparation. Center: Low power microscopic view of entire tooth. Right: High power microscopic view of resorbed area

third molars that are destined to mature into completely or partially unerupted impactions. The determination depends mainly upon the relative proportions of the teeth and the jaws, the position of the developing third molar within the bone, and the condition of the adjacent second molar.

The decision to remove third molar teeth when a patient is young if such teeth are condemned to become hopeless impactions may be considered good judgment. Such a practice will help reduce the high incidence of trouble arising from impacted third molar teeth in general, particularly from those in the mandible. In many instances it will also serve to prevent the loss of sound second molar teeth that will be jeopardized by the retention of impacted third molars.

Treatment of maxillary and malar fractures: *report of case*

■ *Paul E. Jurgens, D.D.S., M.S.D., Decatur, Ill.*

A 30 year old man was admitted on April 14, 1954, to the Veteran's Administration Hospital in Minneapolis with multiple lacerations of the head and legs, loss of some maxillary and mandibular anterior teeth, and fracture of the maxillary and left zygomatic bones.

On April 10, 1954, the patient had been in an automobile accident. He could not remember details of the accident.

The lacerations had been sutured by the referring physician. A note accompanying the patient stated that the blood pressure had remained stable and within normal limits. Tetanus toxoid and antibiotics had been given. Roentgenograms taken at the local hospital revealed a maxillary and left zygomatic fracture.

PHYSICAL EXAMINATION—Examination of the face revealed multiple sutured lacerations. Bilateral periorbital ecchymosis and subconjunctival hemorrhage were present. There was no diplopia. The pupils reacted to light and accommodation.

A visible depression was present over the left malar bone region. Anesthesia was present over the distribution of the left infraorbital nerve. Pain was experienced in the left coronoid process region on movement of the mandible. Bilateral digital examination revealed asymmetry and depression of the left orbital and zygomatic area.

Intraoral examination revealed a transverse fracture of the maxilla. This was demonstrated by grasping various maxillary teeth between the fingers and applying force in various directions. The maxilla moved as a separate unit when this was done. Malocclusion was present from displacement of the maxilla (Fig. 1, left). The mandible appeared normal.

Two maxillary and two mandibular teeth had been lost in the accident and the oral mucous membrane was lacerated in these areas. The tongue, floor of mouth, palate, throat, and buccal walls were normal.

Multiple head roentgenograms revealed a fracture of the left zygoma (Fig. 1, right). A fracture line extended through the anterior walls of the right and left antrums. The right antrum was completely opaque, the left antrum half filled with fluid.

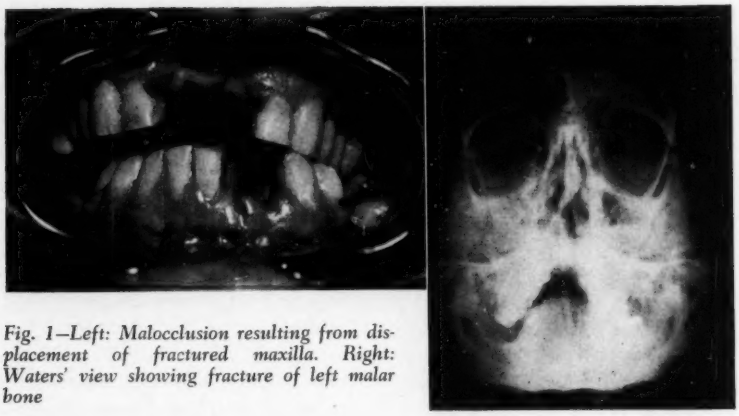

Fig. 1—Left: Malocclusion resulting from displacement of fractured maxilla. Right: Waters' view showing fracture of left malar bone

Physical examination revealed a well-developed, well-nourished, white man who was alert and well oriented. The blood pressure was 140/90, the pulse 74. Some scars were present over the nose from an old injury. The remainder of the examination was essentially negative.

LABORATORY EXAMINATION—The hemoglobin was 14.4 Gm. The white blood count was 6,970 with a normal differential count. The Kahn test was negative. Urinalysis revealed a trace of albumin and a 4+ sugar. The fluid and electrolyte balance was essentially normal.

TREATMENT AND COURSE—Because of the 4+ urine sugar, diabetic urine examinations were ordered (four tests per day). Fasting blood sugar tests and glucose tolerance tests were negative for diabetes. Two days after admission the glycosuria disappeared and all further urinalysis results for the remainder of the hospital stay were negative. In all probability the glycosuria was associated with the head injuty.

On the day after admission, Jelenko splints were placed on the maxillary and mandibular arches under local anesthesia.

An open reduction operation was planned to reduce the left zygomatic fracture in order to achieve optimum apposition and fixation of the displaced bone. On April 16 the patient was prepared for surgery in the usual manner. The anesthetic used was thiopental-curare, nitrous oxide and oxygen. A nasal tracheal tube was passed to assure an adequate airway and to allow the maximum space for the intraoral procedures.

A laceration approximately 3 cm. long was present over the left zygomatic process area. A mosquito forceps was placed in this laceration, and with blunt dissection the skin and subcutaneous tissue were opened. The masseter fascia and muscle were separated by sharp dissection with a scalpel. This exposed the displaced fracture in the zygomaticotemporal suture line region. The temporal process of the zygomatic bone was found to be superior and lateral to its normal position. Manipulation with a Kocher clamp brought the process to its correct position.

A wax spatula was placed beneath the fractured segments to protect the underlying soft tissues, and with a handpiece and bur a hole was drilled approximately 0.5 cm. from the end of each fragment. A 24 gauge stainless steel wire was then placed into the drill holes, tightened, and the twisted end bent over the zygomatic arch, leaving a smooth internal fixation appliance.

This same procedure was repeated at the zygomaticofrontal suture line. Surgical exposure was accomplished with a vertical, curved incision at the lateral orbital margin. The sub-

Fig. 2—Left and center: Postoperative views showing maxillary and malar bones in good position. Right: Postoperative view showing esthetic results of open reduction of left malar fracture

cutaneous tissue, orbicularis oculi muscle and periosteum were all separated by sharp dissection. Separation of the fracture at this suture line was approximately 0.5 cm. The eye was carefully protected at all times.

Holes were again drilled and the stainless steel wire passed through them. Tightening of the wire brought the zygomatic bone into excellent position. The depression of the left inferior orbital margin had been corrected.

The periosteum, muscle and subcutaneous tissues of the operative sites were closed with buried no. 0000 catgut suture. The skin was closed with no. 00000 interrupted silk sutures. Collodion dressings were then placed for protection and support.

With manual pressure the maxilla was replaced insofar as possible into its normal position. The occlusion was not normal at this time however. Intermaxillary elastic traction was established as the patient was responding at the completion of the operation.

PROGRESS—By the following day the steady, continuous pull of the elastics had brought the teeth into occlusion. The left eye was swollen shut from edema. The vital signs were stable immediately after the operation, during the night and the next day.

By the third postoperative day the edema of the left orbital region had subsided. Postoperative roentgenograms revealed the maxillary and malar bones to be in good position (Fig. 2, left and center). On April 20 the intermaxillary elastics were replaced with stainless steel wires and two days later the patient was discharged from the hospital. Final postoperative observation one month later revealed the fractured parts to be in good position with evidence of complete healing and a good cosmetic and functional result (Fig. 2, right).

SUMMARY—Fractures of the maxilla and malar bones can be treated by various methods. Occasionally it is advantageous to combine intraoral and extraoral procedures to obtain an optimum result.

A case of transverse fracture of the maxilla with a concomitant fracture of the malar bone is reported wherein conservative and open methods were combined to produce the best possible result.—*160 North Edward Street.*

Alveolar soft-part sarcoma of the tongue: *report of case*

■ *Jack B. Caldwell,* D.D.S., M.Sc.; Kenneth W. Hughes,† D.D.S., and Edward J. Fadell,‡ M.D., San Francisco*

The alveolar soft-part sarcoma is a rare neoplasm. It is well recognized as a pathological entity, which as yet has not been definitely classified. Christopherson, Foote and Stewart,[1] in their résumé of twelve cases, qualified the term "alveolar soft-part sarcoma" as tentative, until undisputed origin can be established. The histologic findings have led some authors to consider neoplasms of this type to be a form of paraganglioma.[2,3] Other investigators, on finding apparently identical lesions in skeletal musculature or musculofascial planes of the body, have categorized the entity on this basis and have identified it as myoblastoma.[4-6] Thus it is learned quickly, on perusal of the literature, that the term for this neoplasm, as well as its pathogenesis, remains in question. A better understanding of its origin awaits the accumulation of more comprehensive data.

This tumor usually occurs during the first four decades, with the majority of the cases seen in the latter part of the second decade and during the third decade.[1,2] Lesions exhibiting identical or similar histopathologic characteristics have been reported in association with the skeletal musculature and the musculofascial planes, especially of the lower extremities, retroperitoneally in the area of the organs of Zuckerkandl,[3] and in the area of the carotid bodies.[7,8] The deep lingual tissues are an uncommon site.[1,2]

Occurrence has been reported in either sex. History is ordinarily described as that of a slow growing mass which is usually asymptomatic. Pain is an occasional finding.

Diagnosis is not possible on the basis of the gross appearance of the tumor mass. The lesion is usually moderately firm, circumscribed and at least partially encapsulated. Venous plexuses are often found about the capsule. Intravascular invasion is often found microscopically, but this feature apparently does not affect the prognosis. Metastatic spread does not always follow this finding. When metastasis occurs, the first site usually is the lung.

In the majority of the cases reported, local excision was the most common method of treatment. Radiation, when used, was of doubtful value.

A review of the literature revealed three cases[1,2] in which the lesion occurred about the oral structures. The size of these tumors varied from 1 cm. to 5 cm. in diameter. The age and sex of the patient, and the location and descriptive designation of the lesion in the cases surveyed, including the one reported here, are listed in the table.

The following case illustrates an unusual

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Table
Cases of alveolar soft-part sarcoma

Author	Age	Sex	Location	Designation	Metastasis
Christopherson, Foote and Stewart[1]	12	F	Base of tongue	Alveolar soft-part sarcoma	No evidence of recurrence five years postoperatively
Smetana and Scott[2]	27	M	Posterior triangle of neck, right side	Malignant tumor of nonchromaffin paraganglia	Died within one year—metastasis to lungs, heart and brain
Smetana and Scott[2]	28	F	Inferior to angle of left side of mandible	Malignant tumor of nonchromaffin paraganglia	No evidence of recurrence after four years
Caldwell, Hughes and Fadell	4	M	Base of tongue	Alveolar soft-part sarcoma	No evidence of metastatic spread after one year

occurrence of this tumor in the deep lingual musculature.

HISTORY—A four year old white boy was admitted to Letterman Army Hospital on February 25, 1955, for evaluation of a mass in the base of the tongue. The history dated back to September 1954, when the boy was reported to have developed a speech impediment. At the time, the parents considered this a willful attempt on the child's part to imitate defective speech habits of a playmate. The speech impediment persisted in spite of corrective measures instituted by the parents. During December, the boy was examined by a physician for complaints relative to an infection in the upper part of the respiratory tract. At that time a mass was first noted in the base of the tongue.

The child had remained essentially well during the period of symptoms, although he was noted to have reduced his food intake and to have developed an associated weight loss of ten pounds. There was no history of pain or discomfort.

PREOPERATIVE EXAMINATION — Physical examination essentially was negative, except for the findings of a grade 1 systolic murmur, several small, "shotty," anterior cervical lymph nodes and a golf ball-sized mass in the base of the tongue (Fig. 1, above). Palpation indicated that the mass was firm, well-circumscribed, nontender and deep in the lingual musculature at the base of the tongue. There was no evidence of overlying inflammation or ulceration.

Results of laboratory examination, including routine hematologic examination and

Fig. 1—Above: Preoperative view. Below: Gross specimen showing apparent encapsulation of the soft, opaque, nodular tumor

urinalysis, were negative. Roentgenographic examinations of the lesion and of the lungs were negative. After complete examination and presentation of the case to the tumor board for evaluation, the patient was taken to surgery March 1.

SURGICAL PROCEDURE — Under general anesthesia, accomplished through a naso-endotracheal airway, it was possible to palpate the mass carefully and completely. It appeared to be deep in the base of the right side of the tongue. Aspiration of the mass was nonproductive. Approach for removal of the mass was made through an incision on the right lateral border of the tongue. A venous plexus was encountered overlying the mass. Hemostasis was secured, and the entire lesion was dissected free.

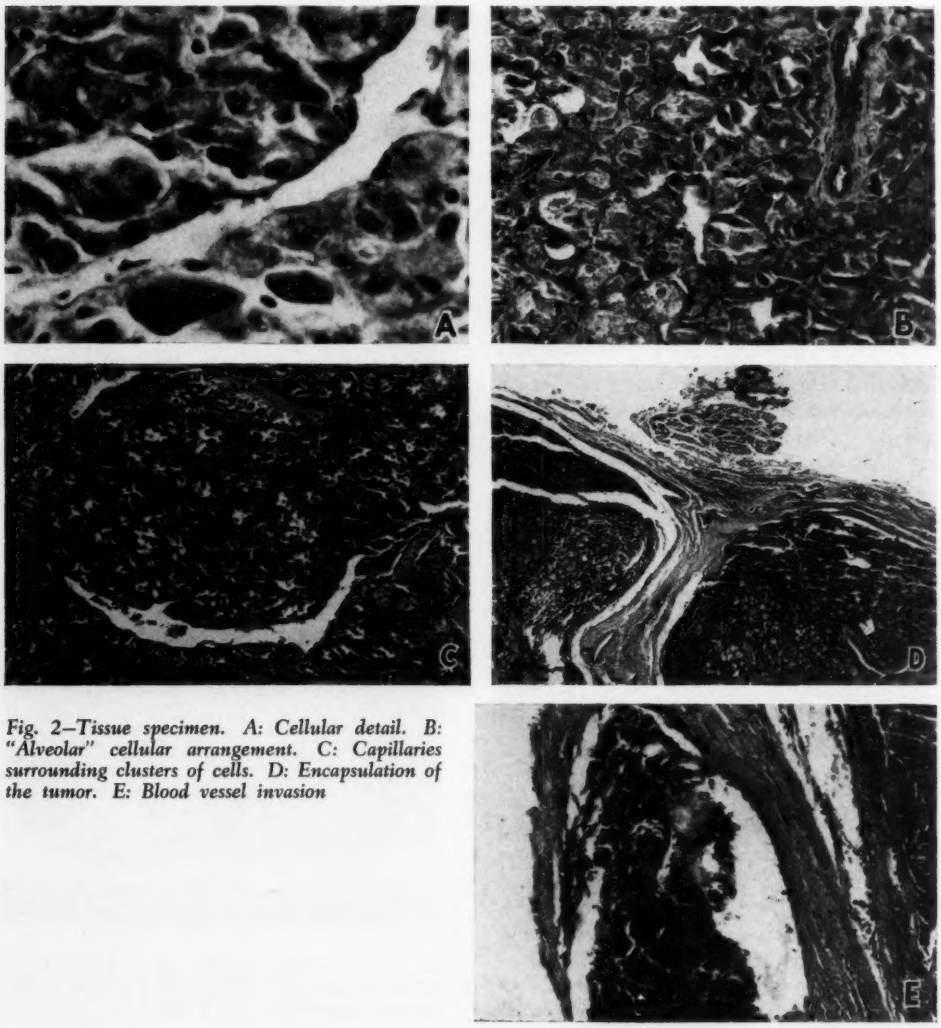


Fig. 2—Tissue specimen. A: Cellular detail. B: "Alveolar" cellular arrangement. C: Capillaries surrounding clusters of cells. D: Encapsulation of the tumor. E: Blood vessel invasion

It appeared to be well encapsulated. Complete removal was believed accomplished. Histologic examination was accomplished with a frozen section of the excised tissue, but a firm diagnosis could not be made. The tongue was closed primarily, and the patient was returned to the ward in good condition. The postoperative course was uneventful. At the time of discharge from the hospital on March 7, normal healing was in progress at the operative site.

PATHOLOGY REPORT—The gross examination established that the mass measured 4 by 4 by 3 cm. The outer surface showed attached surrounding tissue and had an irregular nodularity. Sectioning revealed apparent encapsulation with the bulk of the tumor mass being composed of a rather soft, opaque tissue having a somewhat muddy appearance. Focal areas of evident hemorrhagic disruption of tissue were noted. In some areas, the material became somewhat pultaceous (Fig. 1, below).

The microscopic examination revealed that the sections of tissue showed a proliferation of large oval or polyhedral cells having abundant eosinophilic cytoplasm and moderately large nuclei. The cellular outlines usually were well defined. Many of the nuclei showed fairly prominent nucleoli. In general, the cytoplasm stained intensely eosinophilic, and many of the cells had a fine to coarse cytoplasmic granularity (Fig. 2, A). In some areas, a somewhat "alveolar" pattern was evident (Fig. 2, B). Also noted, most evident where alveolar pattern predominated, were capillaries which seemed to be elongated and somewhat compressed by the proliferating cells (Fig. 2, C). In general, nuclear uniformity was seen; however, rather deeply staining nuclei with evident chromatin clumping were encountered occasionally. A capsule could be identified (Fig. 2, D); however, it was noted that the cellular proliferations involved the capsule. A tumor was demonstrable within vascular channels (Fig. 2, E). Occasionally, groups of cells were seen to invaginate the wall of larger vessels.

The diagnosis was alveolar soft-part sarcoma of the right side of the base of the tongue.

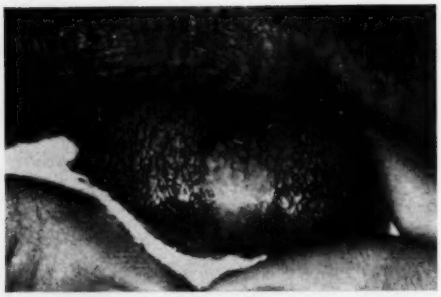
SUMMARY—A case of an unusual and rare oral tumor is reported. Although the pathogenesis and the term for this tumor are in dispute, the lesion clinically represents one more entity which must be considered in the differential diagnosis of neoplasms occurring in and about the musculature of the oral cavity.

Benign granular cell myoblastoma of tongue: *report of case*

■ *David J. Kennedy, D.D.S., Syracuse, N. Y.*

A 41 year old man came to the office on June 18, 1954, for examination and treatment of a mass on the tongue. The patient reported that a lump appeared on the tip of his tongue 2 or 3 years previously. It had enlarged very slowly, was neither tender nor painful. He stated that it, "felt like a rash."

The mass was whitish in color, stony hard, devoid of papillae and about 12 mm. in diameter. It was wedge-shaped and extended from the dorsal to the ventral surface of the tongue (illustration). Tongue movements were not disturbed. There were numerous missing teeth, and evidence of leukoplakia ex-



Tumor on dorsum of tongue at tip

isted on the buccal gingiva of the maxilla and mandible.

The patient smoked two packs of filtered cigarettes a day. He had a habit of sticking the tip of his tongue into the opening of the filter tip. Since this irritation could have contributed to the formation of the mass, he was advised to refrain from smoking.

There was no family history of tumors. The patient's medical history was negative except for removal of a cyst from his arm and recurrent surgery for cervical glands at ages 5 and 10.

The whitish appearance of the lesion was suggestive of leukoplakia, and the induration aroused a suspicion that premalignant or malignant change had taken place. No cervical adenopathy was detectable.

Infiltration anesthesia was used posterior to the mass and an excisional biopsy specimen taken. The incisions were extended to grossly normal tissue. The specimen was examined microscopically and was reported as follows: "Benign granular cell myoblastoma with pseudoepitheliomatous hyperplasia of the epidermis."

Sutures were removed in five days and healing progressed normally. To date there has been no recurrence of the tumor.

DISCUSSION—Thoma[1] provides an excellent résumé of this tumor. In general, myoblastomas are small, circumscribed, slow growing and benign. They are sometimes found in the cheek, soft palate and uvula. It is formed from mesenchymal cells which form striated muscle tissue whereas the leiomyoma arises from mesenchymal cells forming smooth muscle. Thoma further states that the component cells are large granular myoblasts, embryonic in type. The tumor is also called a granular cell rhabdomyoma. The malignant form of this tumor is the rhabdomyosarcoma. Treatment of choice is surgical excision.

SUMMARY—A patient was seen who had a neoplasm of the tongue. Because of the presence of leukoplakia elsewhere in the mouth, it was felt that the lingual lesion might represent leukoplakia with underlying premalignant or malignant change. An excisional biopsy specimen was taken. The incision was carried well beyond the tumor bounds into grossly normal tissue. The specimen was reported as benign granular cell myoblastoma.—*1146 Meadowbrook Drive.*

■ HUMAN NEGLIGENCE

Minds that are stupid and incapable of science are in the order of nature to be regarded as monsters and other extraordinary phenomena; minds of this sort are rare. Hence I conclude that there are great resources to be found in children, which are suffered to vanish with their years. It is evident, therefore, that it is not of nature, but of our own negligence, we ought to complain.—***Marcus Fabius Quintilian.***

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The human side of oral surgery

VOLUMES have been written about the technical aspects of oral surgery with little attention devoted to the humane aspects of our specialty. Admittedly, there is a continuing need for technical improvement; however, more emphasis should be placed on patient management and public relations.

It is well established that most people are fearful of the various surgical procedures that all of us carry out in our daily practice. Many patients are outwardly nervous and apprehensive whereas others manage to maintain an outer calm that usually belies their true inner feelings. In either event, for them, it is usually an unpleasant experience which must be endured. To face it in inhospitable or unpleasant circumstances with personnel that have a lack of sympathetic understanding, heightens the unpleasantness and lowers the patient's esteem of all personnel concerned.

At the present time, all men who train in oral surgery receive the major portion of their experience in a hospital or large clinic. Most have had two years of caring for Armed Forces personnel. Frequently, such a vast clinical work load tends to make the professional personnel indifferent to the management of the human emotions that are always present. Young men who develop such habits and eventually carry them over into private practice may well find that it is harmful not only to their own individual reputation as an oral surgeon, but also to the reputation of the entire specialty of oral surgery as well.

In addition, auxiliary personnel should not only function with efficiency and dispatch, but also with a degree of charm and compassion that is commensurate with the physical and mental trauma the patient must endure. Individually prescribed sedation when indicated, adequate local anesthesia and properly administered general anesthesia combined with technical skill, are of course imperative in any successful practice. Clean, attractive, modern surroundings and efficient, sympathetic personnel are also of great importance, however, if an optimum end result is to be attained. Actually, a technically excellent result can be completely unappreciated by a patient if it is not accompanied by sympathy and understanding. It is therefore wise for all of us to re-examine periodically our attitudes and facilities if we are to be truly successful in the practice of our chosen specialty.—*Fred A. Henny.*

■ Bone Disturbance From Chronic Inflammation

Q.— An 11 year old boy exhibits a chronic hard swelling over the left body of the mandible. An abscessed first molar was removed in this region three months ago. Examination of the extraction site indicates satisfactory healing, and there is no drainage. Roentgenograms demonstrate an expansion of the body of the mandible. What course of treatment is indicated for this condition?

A.—The low grade inflammatory response seen here suggests a chronic proliferative periostitis. This alteration does not have the implications of a classical osteomyelitis. If the clinical signs do not indicate activation of infection, the periosteal reaction may become dormant and later regress with remodeling of the part. Attention to supportive care and alertness for drainage needs of any localized suppurative process constitute the basic requirements. Changes in the roentgenographic evidence or clinical course may indicate biopsy procedure. A residual expansion which produces asymmetry may require surgical intervention later to restore normal contour.

■ Sterilization of Anesthetic Syringes

Q.—What sterilization technic is most satisfactory for anesthetic syringes?

A.—Autoclave sterilization is considered to be the surest method for elimination of the more refractory organisms. Boiling may be a second choice, but it has certain limitations. If Luer type syringes are used, they should not be sterilized in alkaline solutions. Residual alkaline deposit in the barrel of such syringes may precipitate the free base of anesthetic solutions in the syringe and prevent effectiveness of the solution *in vivo*.

■ Extraction of Teeth After Radiation Therapy

Q.—What problems may be anticipated after the removal of lower teeth in a patient who had roentgenographic treatment for a malignancy of the tongue five years previously? The disease has apparently been cured.

A.—The impairment to the blood supply of the bone in the mandible may still predispose to postirradiation osteonecrosis complications. If the removal of the teeth can be avoided through restorations or endodontic treatment, it would appear wise to follow such procedure. When extractions are imperative, efforts to minimize trauma and to obtain adequate antibiotic coverage are advocated. However, these precautions are not fully protective, and the patient must be fully informed of the potential complications in the procedure.

■ Sectioning of Teeth

Q.—What are the indications for the division of teeth as a part of the technic in removal?

A.—Tooth sectioning is a well-accepted, conservative measure which preserves the contour of the alveolar process and facilitates the removal of multirooted and other refractory teeth with minimal trauma and control of force. Whenever there is a decision to remove useful bone or to divide tooth structure, it is obvious that the division of the tooth and conservation of bone are logical.

This section devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners is edited by James R. Hayward, University Hospital, Ann Arbor, to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor

■ Orienting Biopsy Specimens

Q.—When a large tissue specimen is taken for pathological examination is there a method for marking so that the pathologist may describe the changes in a particular area? For example, a large leukoplakic lesion may have a particularly suspicious area at one border to which you wish to bring attention.

A.—When the lesion has been partially removed, a suture may be placed in the specimen at one of its margins and loosely tied. This will serve as a marker for orientation, and should be indicated in the written description which accompanies the biopsy specimen. If further surgery is indicated on the basis of the biopsy report, the orientation will be preserved in a helpful manner for secondary surgical intervention.

■ Loss of Sensation in Lower Lip

Q.—A 45 year old patient complains of a numbness which developed spontaneously in the region of the lower lip and chin on the left side. What are the probable causes?

A.— Sensory loss over the region of the mental branches of the inferior alveolar nerve has numerous possibilities. Of the organic disturbances, the most frequent cause is trauma; the most serious cause is nerve invasion by neoplastic disease, either primary or metastatic in peripheral nerve or central nervous system regions. If there is no evidence of trauma, a thorough roentgenographic and neurologic evaluation must supplement the usual clinical investigation of the anesthesia symptoms.

■ Oronasal Fistula in Repairing Cleft Palate

Q.—A seven year old child with a postoperative cleft lip and cleft palate has a 0.5 cm. perforation in the labiogingival sulcus in the line of the alveolar cleft. This does not appear to cause much difficulty. When should this defect be closed?

A.—Although local conditions vary in regard to this situation, the usual policy is to wait until full eruption of the permanent dentition. The presence of malposed and supernumerary teeth in this region and the need for orthodontic treatment make this region a dynamic zone in the cleft palate patient. Surgical requirements of the situation may be determined more accurately when the dentition and alveolar bone are stabilized.

■ Diffuse Radiopaque Mass over the Mandible

Q.—A routine lateral roentgenogram of the jaw of an elderly patient demonstrated a diffuse radiopaque mass over the lower ascending ramus of the mandible. A second film with a different projection shifts the mass posteriorly and below the inferior border of the mandible. There have been no symptoms associated with this condition. What are the diagnostic possibilities?

A.—Since the calcified mass in question is located in soft tissues, the most probable sites for it would be in regional lymph nodes or in the submaxillary gland. Calcific changes in regions of chronic inflammation are seen as phenomena of regeneration and repair.

■ The increased rate of fatal anaphylactic reaction to parenterally administered pencillin has resulted in increased interest in the oral form of this drug. Present research indicates that satisfactorily high blood levels can be attained by oral administration, producing therapeutic responses in diseases which were heretofore not considered safe to treat by this method. Therefore, it is to be expected that there will be a gradual increase in oral administration and a relative decline in the parenteral form during the ensuing years.

■ Despite publicity inferring that dental extractions should not be done for children during the so-called polio season, there is no scientific evidence to indicate that there is any connection between extractions and polio. It is obvious that since so many dental extractions are done for children throughout the year, there will be an occasional coincidence of events and that some postextraction patients will subsequently develop poliomyelitis. However, it is impossible at the present time to establish a direct connection between the two events.

■ There is need for a more potent analgesic for ambulatory postoperative oral surgery patients. Although codeine usually is adequate it does not control pain sufficiently in many instances. In addition, like meperidine and morphine, it has side effects that are frequently undesirable. Present research indicates a fresh interest, and it is hoped that a more adequate analgesic with little side effect will be developed in the near future.

■ Mixed tumors of the parotid gland displace the branches of the facial nerve and do not directly involve them, while carcinomas in this region frequently involve the nerves directly, producing unilateral facial paralysis. This difference aids in differential clinical diagnosis of these two lesions.

■ In general anesthetic procedures in oral surgery, proper obliteration of the oral pharynx by gauze packs is of great importance. It is necessary primarily to prevent aspiration of foreign bodies, blood and mucus into the throat and also to facilitate exchange of gases and vapors to maintain proper balanced anesthesia. A gauze roll, made from a 3 by 3 inch sponge, placed under the tongue on the side being operated on, along with the other packs that are used as partitions, materially aids in this respect. The gauze roll occupies an otherwise open space which exists between the tongue, the floor of the mouth and the alveolus. This roll also helps in managing the tongue by retracting it from the alveolar region where the surgery is being performed. A gauze roll, carefully placed under the tongue, is also of value to the operator during an operative procedure under local anesthesia.

■ In sectioning impacted teeth with a chisel, a sharp, bi-bevel chisel is the best instrument to use. The position of the tooth must be fully established by roentgenograms and clinical exposure so that the operator can identify the anatomic grooves and root bifurcation before attempting to accomplish the split. A short but decisive tap from the mallet, with the chisel held directly parallel to the long axis of the tooth, is also of primary importance. Care should be taken not to loosen the tooth with elevators or by removal of too much bone before attempting the sectioning. Teeth with incompletely formed roots or with fibrous ends that tend to act like a cushion do not as a general rule split satisfactorily with a chisel and are best sectioned with a dental bur.

■ In the removal of an impacted maxillary cuspid that is palatally positioned an approach from both the palatal and labial aspects often facili-

Readers are invited to send their clinical observations to the editor, Fred A. Henny, Henry Ford Hospital, Detroit.

tates the surgical procedure. Frequently it is difficult to obtain adequate leverage with an elevator without damaging adjacent teeth after the impacted tooth has been exposed. In many instances, the root formation is such that the curvature does not permit elevation from the palatal surface. In these instances a window cut through the buccal cortical plate to expose the tooth and permit engagement of an elevator from this aspect, after the crown is sectioned, is a satisfactory and sound surgical procedure.

■ In removing the remnant of a developmental sac or granulation tissue surrounding an impacted mandibular third molar that is lingually inclined, one must be careful not to section or traumatize the lingual nerve which is close to the structures in this region. Frequently a portion of tenacious tissue may be retained best if it is superficial and if the lingual nerve is not clearly identified and the tissue will not dissect cleanly away from the region. Usually, with careful dissection, all remnants of granulation tissue or remnants of the dental follicle can be removed with preservation of all surrounding normal structures.

■ A common error in outlining soft tissue flaps for the surgical removal of teeth lies in not providing for adequate relaxation of the soft tissue. Tissue is then unduly traumatized, and, therefore, does not heal properly, thus causing increased postoperative pain. Whether the incision is curved, straight or angular is not too important in most instances if the following cardinal principles are followed: (1) The incision must be made sharply through the entire mucoperiosteum. (2) The incision should be made a distance away from the site of intended bone removal, and the flap reflected cleanly so that when it is replaced it may be reapproximated over intact bone. (3) The incision for the flap is made with consideration for the normal landmarks such as frenums, muscle attachments and nerve and vascular supply of the mucoperiosteum. (4) The incision must be planned so as to provide the best access to the surgical site, to allow for ease of retraction without traumatizing the tissue and to permit proper closure of the relaxing incision.

■ Teeth should always be tested for vitality if clinical examination is negative but roentgenograms show periapical radiolucency. In the anterior mandible particularly, a periapical fibroma is a rather common pathologic lesion. It is not inflammatory or degenerative in nature but rather is a radiolucent stage of cementoma formation. This tumor forms at the expense of bone and can often be mistaken for a granuloma or small radicular cyst. Differential diagnosis can be established only if the related tooth is normal and if there is no pulp or periapical infection. Teeth in this condition should not be extracted or devitalized, unless the cementoma becomes large enough to cause facial disfigurement.

■ FRACTURES OF THE FACIAL SKELETON. By N. L. Rowe and H. C. Killey. 923 pages with 1,231 illustrations, 14 in full color. Index. Baltimore, The Williams & Wilkins Co., 1955.

In the preface to this excellent book, the authors state, "In attempting to provide a book of reference which will be of value not only to the specialist in maxillofacial injuries but also to others who may be called upon to deal with injuries of this nature, we have been faced with the problem of providing information which would be adequate for both the surgical and dental members of a combined team without being unnecessarily detailed or confusing for either side. . . . . we felt that it would be preferable to include too much data rather than too little. . . . . ."

To say that this book includes too much detailed information would be incorrect, for it is this very careful and thorough attention to all the aspects of this important subject which makes the volume such an outstanding work.

The book is divided into three parts, the first of which deals with fractures of the mandible. In this part, applied surgical anatomy, classification of fractures and the clinical and roentgenographic examinations are discussed thoroughly. Then, various technics of interdental wiring and the construction of cast metal cap splints are presented. The problem of the edentulous mandible, fractures of the condyle, fractures of the mandible in children and the complications arising in the treatment of fractures are dealt with next.

The second part of the book is entitled, "Fractures of the Middle Third of the Facial Skeleton." Here again, the thoroughness which was evident in the treatment of mandibular fractures is encountered. The attention to detail and the clear, concise description of the various aids to diagnosis, as well as the presentation of different methods of treating these fractures is refreshing and worthwhile.

The third section deals with gunshot wounds of the face and jaws, the diagnosis and treatment of residual traumatic deformities, anesthesia, roentgenology, postoperative care and the use of metals in the fixation of fractures of this region. An excellent chapter on the healing of fractures and the union of bone grafts is included.

The book has an excellent bibliography and is well indexed. It can be recommended as a valuable addition to all who may be interested in this field of study.—*Marvin Revzin.*

■ ORAL CANCER AND TUMORS OF THE JAWS. By George S. Sharp, Weldon K. Bullock and John W. Hazlet. 561 pages with 642 illustrations. Index. $15. New York, McGraw-Hill Book Co., 1956.

The authors have prepared a well written, generously illustrated book covering benign and malignant tumors of the mouth and jaws. Considerable emphasis is placed on diagnosis, and the large number of well made photo-illustrations aid greatly in the presentation. No aspect of this interesting subject is neglected, except for illustrations of operative technics used by the authors. Treatment is described in sufficient detail, however, to provide an over-all philosophy of the management of each entity.

Chapter three is devoted to the classification of neoplasms, and, therefore, in a sense, outlines the content of the text. Chapter four covers biopsy technic, including armamentarium, anesthesia and the carrying out of the actual biopsy procedure. Chapter five outlines precancerous pathology and aids the reader in understanding the pathologic changes that occur prior to the development of malignant degeneration.

In addition to discussing the lesions occurring in each portion of the mouth, the authors discuss also the advantages and disadvantages and indications and contraindications for radiation and surgical therapy. Part three includes six chapters on various benign and malignant tumors arising from tissues other than

the oral mucous membrane. A chapter is included also on metastatic bone tumors. Part four devotes five short chapters to quasi-tumors of the jaws including the exostoses, fibrous dysplasia granulomas, metabolic diseases involving bone and odontogenic hamartomas.

Over-all, *Oral Cancer and Tumors of the Jaws* is an excellent treatise on the diagnosis and general principles of treatment of oral neoplasms. Details of treatment and patient management are not covered; the text is primarily designed to stimulate early diagnosis and subsequent treatment. It is indeed worthy of a place on the book shelf of everyone interested in this field.—*Fred A. Henny.*

■ The American Drug Index. By Charles O. Wilson, Ph.D., and Tony E. Jones, M.S. 576 pages. $5. Philadelphia, J. B. Lippincott Co., 1956.

This book consists of an alphabetical list of drugs by generic and trade names, with cross references. In the case of mixtures, the quantitative composition is given. Available dosage forms, such as ampule, vial or tablet, are stated together with the name of the manufacturer. Use and route of administration are specified in many instances.

The typography and paper are good. The material has been arranged carefully and competently. The book is addressed to dentists as well as to physicians, pharmacists, nurses, students, teachers and sales personnel.

In order to estimate roughly whether the listing of dental drugs was sufficiently comprehensive, the reviewer looked up common dental product constituents by the first 35 names which entered his mind. Of the 35 names he found 25. One of the 25 was inadequately cross-indexed. The names not found were Unacaine, Supranol, Gardol, sodium lauroyl sarcosinate, Irium, Anacin, Fluoristan, stannous fluoride, GL-70 and Poloris poultices.

It is immediately admitted that two of the unlisted names, Fluoristan and stannous fluoride, refer to drugs only recently introduced on the market. The index still does not cover the dental field as well as its second edition probably will.

Despite limitations in its dental scope, the *American Drug Index* represents a worthy attempt to fill a definite need. It will be useful to those who are interested in the composition and nomenclature of currently available drug products. It should certainly be in the library of every dental school and dental editor.—*Donald A. Wallace.*

■ Cancer Cells. By E. V. Cowdry. 677 pages with 137 illustrations. Index. Appendix. $16. Philadelphia, W. B. Saunders Co., 1955.

Large monographs in the biological sciences are a rarity in the modern scientific literature. This paucity reflects the increasing complexity of the disciplines. There are, perhaps, in the English-speaking countries, few scientists of sufficient breadth of understanding able or willing to undertake such monographs. It is, therefore, a noteworthy event when a major work of this type is published.

The appearance of E. V. Cowdry's monograph *Cancer Cells* is cause for appreciation since the expanding field covered is still in need of broad synthesis and integration of the diverse materials and data which compose it. A work of this magnitude serves both to summarize current and past data as well as to indicate fruitful paths of future research.

Dr. Cowdry's text attempts to synthesize morphological, cytological, chemical, epidemiological and ecological data. His success is remarkable. To be sure, individual scientists, specializing in particular on more narrow aspects of cancer research (indeed, active research today requires narrowness in this context) may object to, or be irritated by, Dr. Cowdry's interpretation of certain data, by his omission of particular pet references (almost unavoidable among the mass of data collated), or by the absence of those platitudinous remarks about cancer which infest much of the literature. All must, however, be grateful for this thoughtful summation of so much material.

The type is clear, the print and format excellent. The book is remarkably free from errors. Many of the illustrations are superb. The monograph is worthy of a place of prominence in the library of every scientist.—*Charles E. Wilde, Jr.*

■ Dental Extraction During Dicumarol Therapy. John Marin Askey and Clifford B. Cherry. California Med. 84:16 Jan. 1956.

When patients are receiving long term antithrombotic therapy with bishydroxycoumarin (Dicumarol), a potent anticoagulant, they are commonly warned against the hazards of prothrombin reduction, including the danger of hemorrhage after dental extraction.

Failure to instruct one patient resulted in an experience which may revise opinion on this matter. The patient mentioned that he had had several teeth extracted recently. The dentist, surprised to learn that the patient had been taking bishydroxycoumarin, reported that there had been no unusual bleeding.

A second patient required dental extractions, but the oral surgeon was loath to extract the teeth unless the patient discontinued antithrombotic therapy which had been started three years earlier after a cerebral thrombosis with hemiplegia.

The patient pleaded his own case well in a letter to the oral surgeon: ". . . If I desist from taking Dicumarol for four days there is the possibility that I might have another thrombosis. If I do take it, there is another possibility (which I personally think is somewhat less) of excessive bleeding from the extraction. . . . It is my deliberate desire and deliberate wish to take the second risk. . ."

Three teeth were extracted without unusual bleeding, and a fourth was extracted later. After these two experiences, antithrombotic therapy was continued through dental extractions with other patients. Six patients in the medical care of the authors have had 14 extractions. The average age of these patients was over 65 years. The results indicate that the risk of bleeding from dental extraction during bishydroxycoumarin therapy is much less than has been suspected.

The absence of excessive bleeding can be explained reasonably. In external surface bleeding, pressure can be applied and tissue juice is available as a source of thromboplastin; therefore, the bleeding usually is easily stopped.

This report should not be construed as evidence that there is no need ever to discontinue bishydroxycoumarin therapy for dental extractions. The prothrombin deficiency presumably could lead to serious bleeding, although no instances have been reported.

Most patients can safely discontinue the antithrombotic therapy for four days. Each patient must be evaluated in an attempt to identify those who are likely to have thrombosis if the drug is stopped. If such patients require dental extraction, the risk of bleeding is much less than the risk of thrombosis. Should hemorrhage occur, available K_1 preparations can produce a rapid rise in prothrombin activity.

■ The Use of Succinylcholine During Endotracheal Extubation. Ronald S. Lambrie and Frank Pfaff. Anesthesiology 17:47 Jan. 1956.

Endotracheal extubation is generally performed during light planes of anesthesia and at a time when muscle tone has returned. This stimulates the upper respiratory tract and causes the so-called bucking reflex. Bucking will considerably increase cerebrospinal fluid pressure, cause hypoxia and may allow for aspiration during extubation.

Succinylcholine will produce, during extubation, a short period of profound muscular relaxation during which the endotracheal tube may be removed without trauma, and a complete toilet of the upper respiratory tract may be performed. Thirty-six patients were studied; a single injection of succinylcholine was used at the time of extubation for 20 of them; the remainder served as controls. During this period of extubation, continuous oximetric and electrocardiographic observations were recorded. With the use of succinylcholine, the decrease of oxygen saturation during extubation is mini-

mal; a thorough toilet of the supralaryngeal region is possible, and the postanesthetic sore throat is minimized. Artificial respiration may be necessary when succinylcholine is used during extubation; however, full oxygen saturation may thus be maintained. This procedure decreases the hypoxia and helps control a factor in the chain of events which leads to cardiac arrest.

Since the reported controlled study, extubation on 125 patients has been performed with this technic. The incidence of bucking was 5 per cent with no other complications attributable to the technic.

■ Reconstruction of the Temporomandibular Joint. Edward C. Hinds, M.D., D.D.S., and John E. Pleasants, D.D.S. Am. J. Surg. 90:931 Dec. 1955.

Nonfunctioning of the temporomandibular joint may be caused by ankylosis resulting from infection or trauma, traumatic injuries resulting in fracture of the neck of the condyle or dislocation of both, and arthritis, particularly of the rheumatoid variety. Some authorities have advocated simple cutting of the neck of the condyle for ankylosis of the temporomandibular joint. Others have advocated condylectomy, while still others prefer to resect a large portion of bone from the ascending ramus of the mandible.

With these procedures, immediate results are good. However, if the patients are carefully followed, certain complications may be noted. If the condition is unilateral, the powerful muscles of mastication exert their pressure, and the jaw may deviate to the affected or operated side. The point of the chin is no longer in the midline, and there is marked asymmetry of the jaw, flatness of the face on the opposite side and an appearance of facial obliquity.

In addition to the distressing cosmetic results, there is malocclusion, and the patient is unable to masticate his food properly. If the condition is bilateral, there may be a severe malocclusion typically characterized by an open bite. A procedure is described in which a block of rib cartilage is implanted at the site of the condylectomy to prevent collapse of intermaxillary distance. In some of the operations described, a Kirschner wire was passed through the superior border of the zygomatic arch and into the cartilage to prevent the cartilage from slipping out of position laterally. Intermaxillary elastic traction is also used to help stabilize the mandible for the necessary two to four week period. The procedures are described in detail.—*Irwin A. Small.*

■ Speculations Regarding the Nature of Gingival Hyperplasia Due to Diphenylhydantoin Sodium. W. A. M. Van Du Wast. Acta Med. Scandinav. 153:399 Jan. 1956.

Diphenylhydantoin sodium (Dilantin) has been proved to be a useful drug in the control of epilepsy. However, about 40 per cent of dentulous patients treated with diphenylhydantoin sodium develop a hyperplastic gingivitis. Gingival hyperplasia is not a factor in edentulous patients. In this investigation, 23 patients treated with the drug and exhibiting gingival hyperplasia were used. Biopsies were performed of the hyperplastic tissue and bone marrow. Morphological blood examinations were completed on all patients.

Histologically, both the epithelium and submucosa were noticeably hyperplastic with a dense infiltration of mononuclear cells, most of which seemed to be plasma cells. Plasma cells are said to produce antibodies, and an increase of the blood gamma globulin level was noted in 20 of the 23 patients. The bone marrow biopsies and morphologic blood studies were within normal limits.

Side effects of drugs may be toxicity or allergy. It is felt that the gingival hyperplasia reaction to diphenylhydantoin sodium is on an allergy basis, because of the plasma cell infiltration, the increase of gamma globulin of the blood, the fact that the drug group to which diphenylhydantoin sodium belongs possesses great sensitizing capacity and because of the other side effects, such as dermatitis, purpura, agranulocytosis and eosinophilia.

Further studies are planned to determine the exact mechanism of the hyperplastic response to the drug by the gingiva.—*William F. Via, Jr.*

■ FIBROUS DYSPLASIA OF THE MANDIBLE. Michael L. Lewin. Am. J. Surg. 90:951 Dec. 1955.

Fibrous dysplasia is a bony lesion in which normal osseous structure is replaced by a fibrous tissue that has osteogenic tendencies. The histopathologic pattern varies greatly, depending on the proportion of fibrous to osseous elements, the pattern of the connective tissue, extent of calcification, number of giant cells and the amount of cyst formation.

The lesion may vary from predominantly fibrous connective tissue with an occasional island of osteoid tissue to a dense trabeculation of immature bone against a background of collagenous substance. Likewise, roentgenographic observations will vary, depending on the histologic pattern; some lesions are radiolucent, other lesions have a mottled and irregular radiopaque density, and others, when there is a prevalence of osseous elements, acquire a ground glass texture.

The craniofacial skeleton is a frequent site of this lesion with the mandible least frequently involved. The disease may involve a single bone, several bones simultaneously, or may stem from multiple foci in a single bone. Familial and perhaps hereditary patterns have been noted.

Clinically, the lesions do not infiltrate contiguous regions, nor do they metastasize. Although the lesions are usually slow growing and self limiting, with long periods of remaining stationary in size or even regressing, the disease may have periods of activity with rapid growth, and the lesions may attain huge proportions.

With the wide variations in the histologic and clinical picture it has been thought that different variants of the lesions represent different clinical entities. Another concept was that osteofibroma and monostotic fibrous dysplasia were identical diseases. Some authorities believe osteofibroma is a progressive, unrestrained condition, perhaps a precursor of a mature osteoma and that fibrous dysplasia is a self limiting disease. When examined clinically and microscopically in different periods of development, however, these various lesions cannot be distinguished from each other. A theory has been advanced that the monostotic form is a connective tissue response to injury, and the polyostotic form a congenital anomaly.

Four case reports are presented to emphasize the differences in clinical behavior possible for fibrous dysplasia even where histologic examination shows the structure to be similar. The modality of treatment, varying from mere observation to radical resection, does not depend on the pathologic diagnosis but on the clinical behavior of the disease.—*Charles C. Alling.*

■ TRACHEOSTOMY. Ricardo H. Bisi, M.D. Surgery 39:263 Feb. 1956.

Several problems arise when a palliative tracheostomy must be performed. An ideal palliative tracheostomy should fulfill the following requisites. It should be of a lower type. Both the skin and the tracheal opening should be large enough and built in such a way as to allow the patient to remain without the tracheostomy tube for long periods of time. Insertion of the tube into the trachea should be a very easy maneuver for the patient. The operation should produce a fixation of the trachea upward and forward. Finally, this procedure should facilitate rapid epidermization of the tunnel connecting the skin opening with the tracheal opening. One tracheostomy uses a presternal flap in the shape of an inverted U, which is sutured to the lower rim of a square window created on the trachea. This operation solves many of the problems that arise when a palliative tracheostomy has been performed.—*Irwin A. Small.*

Announcements

■ New Oral Pathology Sets Available on Loan

Two new study sets, "Lesions of the Jaw Bones" and "Oral Pathology (Large Set)," have been completed by the Registry of Oral Pathology. The study sets may be borrowed without charge for a period of two weeks. They may be obtained from Col. Joseph L. Bernier, (DC) USA, chief, Oral Pathology Branch, Armed Forces Institute of Pathology, Washington, D.C. "Lesions of the Jaw Bones" contains 50 2 by 2 inch copies of roentgenograms as well as microscopic slides of each lesion. Case histories and commentary are included. "Oral Pathology" contains 100 microscopic slides covering the entire field of dental and oral pathology. A printed syllabus includes clinical notes, microscopic findings and references.

■ Oral Surgery Courses Offered in Schools' Postgraduate Programs

Loyola (Chicago) University School of Dentistry announces a course in anatomy and oral surgery October 19-26. Harry Sicher teaches the first part of the course, and Joseph Kostrubala the second. Dr. Sicher will lecture at the cadaver and will discuss the dissected regions from the clinical point of view. Dr. Kostrubala lectures on pathology and physiology. Students will perform operations on cadavers, including open and closed reduction of mandibular fractures, partial resection of the mandible with bone grafting and resection of the maxilla for tumors.

Also in Chicago, Northwestern University Dental School announces that three courses in oral surgery are listed on its postgraduate program for the 1956-57 academic year. Information on the courses may be obtained from the director of postgraduate study at the school.

The University of Illinois College of Dentistry in Chicago offers a concentrated, full-time two weeks' course in oral and maxillofacial surgery October 15-26. Daniel M. Laskin will direct the course.

■ Symposium to be Feature of Dental Medicine Meeting

A symposium on recent concepts of the temporomandibular joint in relation to fixed and removable dentures and roentgenographic interpretation will be a feature of the December 2 meeting of the American Academy of Dental Medicine. The meeting will be held at the Hotel New Yorker in New York City. Information on the meeting may be obtained from Abraham Reiner, chairman, 114-01 201 St., St. Albans 12, N.Y., or from Andrew Cannistraci, treasurer, 2152 Muliner Ave., Bronx, N.Y.

■ Mexican Oral Surgeons Establish New Society

The foundation of the Mexican Association of Oral Surgery has been announced by Manuel Millán, secretary. The new national organization has as its aim the improvement of the practice of oral surgery, the encouraging of dentists to specialize in the field and cooperation with the Mexican government in selecting capable men for public service. Officers of the group are: Yury Kittler, president; Manuel Millán, secretary, and Marcelino Lara, treasurer.

■ Kurt Thoma Honored by University of Zurich

Kurt H. Thoma, professor emeritus of oral surgery and oral pathology at Harvard University, received an honorary doctorate June 1 from the medical faculty of the University of Zurich. Dr. Thoma was cited for "his distinguished services in the advancement of the pathology and surgery of the oral organs by investigation and instruction." The last honorary degree was awarded in 1927.

■ Early Reservations Advised for Rome Congress

Dentists planning to attend the Twelfth International Dental Congress of the Fédération Dentaire Internationale to be held in Rome September 7-14, 1957, have been advised to make reservations early. A recent communication from Pio Lalli, secretary-general of the Congress, announces that the deadline for hotel reservations is April 30, 1957, and that reductions in the registration fee may be obtained by registration before January 1, 1957.

The pre-January 1 fee is 12,000 Lire (about $19). After January 1, it is 13,000 Lire. Persons who have been supporting members of the F.D.I. since the first of the year may register for half the regular fee.

Reduced rates are paid by families of dentists and others. Before January 1, they are: relatives, 8,000 Lire; undergraduates in dentistry or medicine, 1,500 Lire; hygienists, 6,000 Lire; manufacturers who are not exhibitors, 3,000 Lire. After January 1, the registration fee increases by 1,000 Lire.

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